WORKING TOGETHER IN THE CLASSROOM: AN INVESTIGATION INTO SOFTWARE TO RAISE AWARENESS OF GROUP-LEARNING SKILLS IN CHILDREN AGED 9 AND 10

by
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APPENDIX A: NATIONAL CURRICULUM REQUIREMENTS

The following is taken from the revised National Curriculum 2000 published by the Department for Education (DfES 2000). They are for Key Stage 2; children aged 7 to 11.

The attainment targets are used to describe how well the child has fulfilled the requirements listed in the first section, the National Curriculum requirements.

1. NATIONAL CURRICULUM REQUIREMENTS FOR SPEAKING AND LISTENING

3. LISTENING

To listen, understand and respond appropriately to others, pupils should be taught to:

a identify the gist of an account or key points in a discussion and evaluate what they hear

b ask relevant questions to clarify, extend and follow up ideas

c recall and re-present important features of an argument, talk, reading, radio or television programme, film

d identify features of language used for a specific purpose [for example, to persuade, instruct or entertain]

e respond to others appropriately, taking into account what they say.

4. GROUP DISCUSSION AND INTERACTION

3 To talk effectively as members of a group, pupils should be taught to:

a make contributions relevant to the topic and take turns in discussion

b vary contributions to suit the activity and purpose, including exploratory and tentative comments where ideas are being collected together, and reasoned, evaluative comments as discussion moves to conclusions or actions

c qualify or justify what they think after listening to others' questions or accounts

d deal politely with opposing points of view and enable discussion to move on

e take up and sustain different roles, adapting them to suit the situation, including chair, scribe and spokesperson

f use different ways to help the group move forward, including summarising the main points, reviewing what has been said, clarifying, drawing others in, reaching agreement, considering alternatives and anticipating consequences.

10 The range of purposes should include:

a investigating, selecting, sorting

b planning, predicting, exploring

c explaining, reporting, evaluating.

2. ATTAINMENT TARGET 1: ENG1ISH SPEAKING AND LISTENING

Level 1

Pupils talk about matters of immediate interest. They listen to others and usually respond appropriately. They convey simple meanings to a range of listeners, speaking audibly, and begin to extend their ideas or accounts by providing some detail.

Level 2

Pupils begin to show confidence in talking and listening, particularly where the topics interest them. On occasions, they show awareness of the needs of the listener by including relevant detail. In developing and explaining their ideas they speak clearly and use a growing vocabulary. They usually listen carefully and respond with increasing appropriateness to what others say. They are beginning to be aware that in some situations a more formal vocabulary and tone of voice are used.

Level 3

Pupils talk and listen confidently in different contexts, exploring and communicating ideas. In discussion, they show understanding of the main points. Through relevant comments and questions, they show they have listened carefully. They begin to adapt what they say to the needs of the listener, varying the use of vocabulary and the level of detail. They are beginning to be aware of standard English and when it is used.

Level 4

Pupils talk and listen with confidence in an increasing range of contexts. Their talk is adapted to the purpose: developing ideas thoughtfully, describing events and conveying their opinions clearly. In discussion, they listen carefully, making contributions and asking questions that are responsive to others' ideas and views. They use appropriately some of the features of standard English vocabulary and grammar.

Level 5

Pupils talk and listen confidently in a wide range of contexts, including some that are of a formal nature. Their talk engages the interest of the listener as they begin to vary their expression and vocabulary. In discussion, they pay close attention to what others say, ask questions to develop ideas and make contributions that take account of others' views. They begin to use standard English in formal situations.

Level 6

Pupils adapt their talk to the demands of different contexts with increasing confidence. Their talk engages the interest of the listener through the variety of its vocabulary and expression. Pupils take an active part in discussion, showing understanding of ideas and sensitivity to others. They are usually fluent in their use of standard English in formal situations.

Level 7

Pupils are confident in matching their talk to the demands of different contexts. They use vocabulary precisely and organise their talk to communicate clearly. In discussion, pupils make significant contributions, evaluating others' ideas and varying how and when they participate. They show confident use of standard English in situations that require it.

Level 8

Pupils maintain and develop their talk purposefully in a range of contexts. They structure what they say clearly, using apt vocabulary and appropriate intonation and emphasis. They make a range of contributions which show that they have listened perceptively and are sensitive to the development of discussion. They show confident use of standard English in a range of situations, adapting as necessary.

Exceptional Performance

Pupils select and use structures, styles and registers appropriately in a range of contexts, varying their vocabulary and expression confidently for a range of purposes. They initiate and sustain discussion through the sensitive use of a variety of contributions. They take a leading role in discussion and listen with concentration and understanding to varied and complex speech. They show assured and fluent use of standard English in a range of situations and for a variety of purposes.

APPENDIX B: BRIEFING TO SCHOOLS PARTICIPATING IN STUDY 1

The following letter was sent to the Heads of schools to explain the study and request permission to visit the school. A copy was also given to the three class teachers involved in those schools that agreed to participate.

EDUCATIONAL TECHNOLOGY: CAN IT SUPPORT COLLABORATIVE WORKING FOR CHILDREN AGED 9-11?

I am a PhD student at the University of Birmingham researching whether educational technology can help year 5 and 6 pupils understand and become better at collaborating, that is, whether a computer system can support children working together to achieve a task with all of them acquiring the knowledge, skill and attitude required.

I am about to begin a pilot study to determine whether teachers and pupils would find such a system beneficial, and if so, what would they expect from it.

The study would involve:

- Visiting the class for approximately 3 two hour sessions to observe how collaborative tasks are managed and ICT is used on a practical basis
- When possible having as many of the class as possible spend a short time thinking then drawing or writing about when, how and why they perform group work followed by a series of small group discussions with me about their views for approximately 20 minutes per group
- Interviewing the teachers for approximately half an hour on their views of collaboration, computers, possible curriculum areas for the system, and discussing the children's opinions
- If possible having a meeting between all the teachers involved in the project to compare views

The interviews would be recorded but would remain confidential and the identity of the participants would be anonymous in all reports unless express permission is given.

All work and findings will be made available to the schools.

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APPENDIX C: OVERVIEW OF STUDY 1A

This section describes Study 1a. Three classes participated: a private Year 5 class, a state Year 5 class, and a state Year 6 class. There are five parts to this section:

- C1 is the outline of Study 1a

- C2 is the lesson plan for the Words Ideas Stories Pictures (WISP) board activity performed in the second week

- C3 summarises the reasons from the WISP board activity children gave for doing group work, for example, it is fun, you are encouraged to be independent, it is helpful, and you have to do it.

- C4 is a summary of the mentions made by the children about group format. The ideal size of a group, the ability of children within the group, the gender composition of the group, who should select the group. It also gives the results for group size for computer-based activities, as these are different to classroom based group activities

- C5 gives the subjects that children feel are appropriate for group working

In the last three sections, the quantitative results, *Spoken* refers to mentions made while performing the WISP exercise and *Written* refers to mentions on post-its, plans or recorded speeches.

C1. The outline of Study 1a

This is the summary of the school visits for all three schools participating.

13.1.1	*13.1.2* *Task*	*13.1.3* *Explanation*
1	Observe class performing group tasks.	To give a base line for current working practice.
	Informal discussion with teacher on current use of group work.	To give an idea of how they believe they teach.
2	WISP Board session	To determine what the children perceive, and give another opportunity to view collaboration in action. Possibly form basis for first draft in design phase.
3	Observe class performing group tasks	To see whether reflection on collaboration improved their working practice.
	Informal discussions with pupils on group working	To determine whether children thought reflecting on group working helped.
3a	Interview teacher	To find out perceptions of effectiveness of group work in class, their attitudes towards it, and their opinions of the children's attitude, also whether they noticed a difference in group working after visit 2.

C2. Lesson plan for WISP activity in Study 1a

This is the lesson plan followed in all the schools for the second school visit, the WISP exercise, in Study 1a. It was necessary to ensure consistency between the groups.

Title	Collaborative exercise to determine current understanding of group work
Objectives	To determine what the children understand by group working, its use in classrooms, their opinions of it, and whether a computer could be a helpful support.
Resources	WISP Board, coloured post-its, marker pens, plain paper, tape recorders - one for the stories, one for general recording.

13.1.4	***13.1.5 Method***	***13.1.6 Content***
3	Intro.	Explain to groups of 4 to 6 children that I am looking at how children work together in the classroom and need their help. Want them to work together to fill in the WISP board for me, it will take about 10 minutes, explain that I am going to record them but only so I don't have to take notes and nobody but me will hear it. Reassure them that there is no right or wrong way, they can do all the tasks or just some, doesn't have to be very neat, and at the end we will have a 5 minute talk about what they have chosen and why.
3	Questions and Answers	Show them the WISP Board and ask them for suggestions as to what should go in each area. Explain if they are recording a story to say their name at the beginning so I know who it is.
12-20	Activity	Children fill in the board, if necessary ask: • How many children in an ideal group • Who should choose the groups • How often should groups be used • What subjects are groups used for • What would the ideal classroom have to encourage group work • When was the last time you worked in a group

5 Discuss Go through each four sections and see if they agree about what they have put.

C3. Quantitative results concerning group reasons

REASONS FOR GROUP WORK	PRIVATE - YEAR 5		STATE - YEAR 5		STATE - YEAR 6		TOTAL		PERCENTAGE (%)		
	Spoken	Written	Spoken	Written	Spoken	Written	Spoken	Written	Spoken	Written	Total
Achieve more/ Good work	1	0	0	0	4	1	5	1	2.01	0.56	1.41
Can go outside	3	0	0	0	0	0	3	0	1.20	0.00	0.70
Can teach others	3	0	1	0	6	1	10	1	4.02	0.56	2.58
Comment/check other's work	0	0	0	0	4	2	4	2	1.61	1.12	1.41
Develop leadership skills	0	0	0	0	3	0	3	0	1.20	0.00	0.70
Develop listening skills	0	3	1	0	2	0	3	3	1.20	1.69	1.41
Don't receive attention	0	0	0	0	4	0	4	0	1.61	0.00	0.94
Easier/Share work/Find info/All do something	4	8	5	2	7	2	16	12	6.43	6.74	6.56
Encourage turn taking	0	0	0	0	1	0	1	0	0.40	0.00	0.23
Encourages independence	0	0	2	1	0	0	2	1	0.80	0.56	0.70
Gets work done	0	0	0	0	1	0	1	0	0.40	0.00	0.23
Good/ The "best"	0	0	2	3	0	0	2	3	0.80	1.69	1.17
Have to	1	0	0	0	0	1	1	1	0.40	0.56	0.47
"Helpful"	0	1	9	6	0	0	9	7	3.61	3.93	3.75
"Important"	0	0	2	6	0	0	2	6	0.80	3.37	1.87
Improve communication as must discuss	9	12	5	4	11	9	25	25	10.04	14.04	11.71
Improve confidence	0	0	1	0	0	0	1	0	0.40	0.00	0.23
It's exciting	0	2	0	0	0	0	0	2	0.00	1.12	0.47
It's faster than alone	0	2	0	3	2	2	2	7	0.80	3.93	2.11
It's fun	6	11	1	2	0	0	7	13	2.81	7.30	4.68
Like/ Enjoy/ Interesting	7	2	7	7	3	3	17	12	6.83	6.74	6.79
Make/ improve friendships	3	5	3	2	0	1	6	8	2.41	4.49	3.28
No	0	0	0	0	3	0	3	0	1.20	0.00	0.70

REASONS FOR GROUP WORK	PRIVATE - YEAR 5		STATE - YEAR 5		STATE - YEAR 6		TOTAL		PERCENTAGE (%)		
	Spoken	Written	Spoken	Written	Spoken	Written	Spoken	Written	Spoken	Written	Total
cheating/copying											
"People skills"	0	1	0	0	0	0	0	1	0.00	0.56	0.23
Receive attention	0	1	0	0	3	0	3	1	1.20	0.56	0.94

REASONS FOR GROUP WORK	PRIVATE - YEAR 5		STATE - YEAR 5		STATE - YEAR 6		TOTAL		PERCENTAGE (%)		
	Spoken	Written	Spoken	Written	Spoken		Spoken	Written	Spoken	Written	Spoken
Share or get ideas	9	3	19	8	13	11	41	22	16.47	12.36	14.75
So you can help others	4	6	3	4	11	3	18	13	7.23	7.30	7.26
So you understand	10	3	3	7	6	4	19	14	7.63	7.87	7.73
Stops arguing/being nasty	0	0	0	0	3	3	3	3	1.20	1.69	1.41
Stops being bossy	0	0	0	0	1	0	1	0	0.40	0.00	0.23
Stops copying	0	0	0	0	3	0	3	0	1.20	0.00	0.70
Stops independence (drawback)	0	0	0	0	9	1	9	1	3.61	0.56	2.34
Teachers can comment	0	0	0	0	0	2	0	2	0.00	1.12	0.47
Teamwork/ Cooperate/ Work together	0	3	13	6	9	7	22	16	8.84	8.99	8.90
Work in groups	0	0	0	0	3	1	3	1	1.20	0.56	0.94
TOTAL CONTRIBUTIONS	60	63	77	61	112	54	249	178	100	100	100

C4. Quantitative results concerning group subjects

SUBJECTS	PRIVATE - YEAR 5		STATE - YEAR 5		STATE - YEAR 6		TOTAL		PERCENTAGE (%)		
	Spoken	Written	Spoken	Written	Spoken	Written	Spoken	Written	Spoken	Written	Total
Art	1	1	5	1	0	2	6	4	3.70	5.13	4.17
Computers	1	0	0	0	15	1	16	1	9.88	1.28	7.08
Computers in classroom	7	8	7	3	8	9	22	20	13.58	25.64	17.50
Elocution	1	2	0	0	0	0	1	2	0.62	2.56	1.25
English/reading/ stories	4	1	2	3	9	7	15	11	9.26	14.10	10.83
Not English	3	1	0	0	0	1	3	2	1.85	2.56	2.08
Football	1	0	9	0	2	1	12	1	7.41	1.28	5.42
Games consoles	0	0	0	0	10	3	10	3	6.17	3.85	5.42
Geography	1	2	0	0	0	0	1	2	0.62	2.56	1.25
History/ archaeology	1	2	3	0	0	0	4	2	2.47	2.56	2.50
Maths	8	3	5	0	1	1	14	4	8.64	5.13	7.50
Not maths	3	1	0	0	0	0	3	1	1.85	1.28	1.67
Not tests	0	1	0	0	0	0	0	1	0.00	1.28	0.42
PE	1	0	10	6	5	2	16	8	9.88	10.26	10.00
Play room	0	0	1	0	2	1	3	1	1.85	1.28	1.67
Science	11	9	14	4	2	0	27	13	16.67	16.67	16.67
TV	0	0	0	0	5	0	5	0	3.09	0.00	2.08
Worksheets	0	0	4	2	0	0	4	2	2.47	2.56	2.50
TOTAL CONTRIBUTIONS	43	31	60	19	59	28	162	78	100	100	100

C5. Quantitative results concerning group format

GROUP FORMAT	PRIVATE - YEAR 5		STATE - YEAR 5		STATE - YEAR 6		TOTAL		PERCENTAGE (%)		
	Spoken	Written	Spoken	Written	Spoken	Written	Spoken	Written	Spoken	Written	Total
GROUP SIZE											
work together, write alone	1	0	0	0	0	0	1	0	1.69	0.00	0.99
1	2	2	0	1	0	0	2	3	3.39	7.14	4.95
2	0	1	1	0	1	0	2	1	3.39	2.38	2.97
over 2	0	0	1	0	0	0	1	0	1.69	0.00	0.99
2-4	0	0	0	0	1	0	1	0	1.69	0.00	0.99
3	0	1	1	0	0	1	1	2	1.69	4.76	2.97
under 4	0	0	1	0	0	0	1	0	1.69	0.00	0.99
4	2	4	8	4	10	12	20	20	33.90	47.62	39.60
over 4	0	0	1	0	0	0	1	0	1.69	0.00	0.99
4-5	1	1	3	0	1	1	5	2	8.47	4.76	6.93
5	1	1	2	0	1	0	4	1	6.78	2.38	4.95
2-6	0	0	0	0	1	1	1	1	1.69	2.38	1.98
4-6	1	1	1	0	1	0	3	1	5.08	2.38	3.96
5-6	1	0	0	0	0	0	1	0	1.69	0.00	0.99
under 6	0	0	0	0	1	0	1	0	1.69	0.00	0.99
6	1	1	4	0	2	4	7	5	11.86	11.90	11.88
7	0	0	1	0	0	0	1	0	1.69	0.00	0.99
4-8	0	0	0	0	1	0	1	0	1.69	0.00	0.99
8	0	0	0	0	0	2	0	2	0.00	4.76	1.98
greater than 10	0	0	3	0	0	2	3	2	5.08	4.76	4.95
All	0	0	0	2	1	0	1	2	1.69	4.76	2.97
Even	0	0	1	0	0	0	1	0	1.69	0.00	0.99
ABILITY											
Mixed	3	2	1	1	11	3	15	6	46.88	54.55	48.84
Level	8	4	1	0	8	1	17	5	53.13	45.45	51.16
GENDER											
Mixed	6	2	7	1	9	3	22	6	75.86	66.67	73.68
Separate	1	0	2	0	4	3	7	3	24.14	33.33	26.32
SELECTION											
Not best friends	0	0	0	0	2	1	2	1	6.45	100.0	9.38
Self	3	0	2	0	7	0	12	0	38.71	0.00	37.50
Self & Teacher	0	0	0	0	2	0	2	0	6.45	0.00	6.25
Teacher	3	0	4	0	8	0	15	0	48.39	0.00	46.88

GROUP FORMAT	PRIVATE - YEAR 5		STATE - YEAR 5		STATE - YEAR 6		TOTAL		PERCENTAGE (%)		
	Spoken	Written	Spoken	Written	Spoken	Written	Spoken	Written	Spoken	Written	Total
COMPUTER GROUPS											
1	1	0	1	1	1	1	3	2	5.26	11.76	6.76
2	7	4	0	0	10	6	17	10	29.82	58.82	36.49
2-3	0	0	0	0	1	0	1	0	1.75	0.00	1.35
2-4	0	0	0	0	3	0	3	0	5.26	0.00	4.05
3	0	0	0	0	1	0	1	0	1.75	0.00	1.35
6	0	0	0	0	4	0	4	0	7.02	0.00	5.41
8	6	4	0	0	0	0	6	4	10.53	23.53	13.51
9	2	0	0	0	0	0	2	0	3.51	0.00	2.70
Not alone	3	0	0	0	0	0	3	0	5.26	0.00	4.05
Have a role	0	0	0	0	6	0	6	0	10.53	0.00	8.11
TOTAL CONTRIBUTIONS	53	28	46	10	109	42	208	80	100	100	100

APPENDIX D: INTERVIEW SUMMARIES FROM STUDY 1B

In this section a summary of the quantitative results found from the second study, the interviews with the children are given. The eight groups from the three classes, a state Year 5 class, a state Year 6 class, and a private Year 5 class, have been merged. The results from the interview have been divided according to the three overall goals.

1. Why do you think your teacher gives you group work?

   The main reasons are summarised below:

REASON	% OF GROUPS WHO MENTIONED IT
• To get more ideas	87
• Get on with others	50
• Faster	38
• Achieve more	25
• Learn responsibility for ourselves	50
• Help others	63
• Fun	25
• Easier	25
• To sit round a table	25
• Do best	50

   None of the groups mentioned that the task would affect the style of group work, and only one of the groups identified group work as occurring outside of school, they concluded "The whole world works as a team!"

2. What is the impact of reflection on future group skill usage?

   This was problematic. The groups all asked to have the question clarified. The researcher then asked if they had approached group work any differently in the last week – and if so how. There was a mix of responses, some children felt that they had improved, but could give no specific example, or related an event that contradicted the teacher and the researcher's field notes. Most claimed that there had been no group exercises in the entire week. A few elaborated on existing group practices, girls acknowledged the fact they argue but they know that they are still friends at the end of it. There was a debate as to whether being allowed to help was the same as group work, it was concluded that it was not.

To extend this the children were then asked if they believed that thinking about group work helps people perform in groups any better. The majority of children believed this to be true, although only one group gave an explanation: "as you would realise what you were trying to do". Most of the conversations returned to the importance of sharing ideas, and agreeing that talking was important. Some children were honest and admitted that they had never thought about why they were expected to work in groups.

In the final part of this section of questions, the children were asked if rules should be given for working together. They believed this would help, and the rules suggested for successful group working included: don't be bossy, don't fight or argue, don't mess around, listen to people, just work in a group. There was some confusion however, some groups gave school rules, such as do not talk to strangers. Most groups did not consider the actual idea of whether or not they would be helpful, the exception being one group who felt that rules would not be followed *unless the group had all agreed the rules first.*

3. <u>How should group work be assessed?</u>

The main criteria are summarised below:

METHOD	**% OF GROUPS WHO MENTIONED IT**
• Teacher's mark	38
• All understand the task	87
• Work is completed	50
• All took part	25
• They understand the task themselves	25
• There was no arguing	63

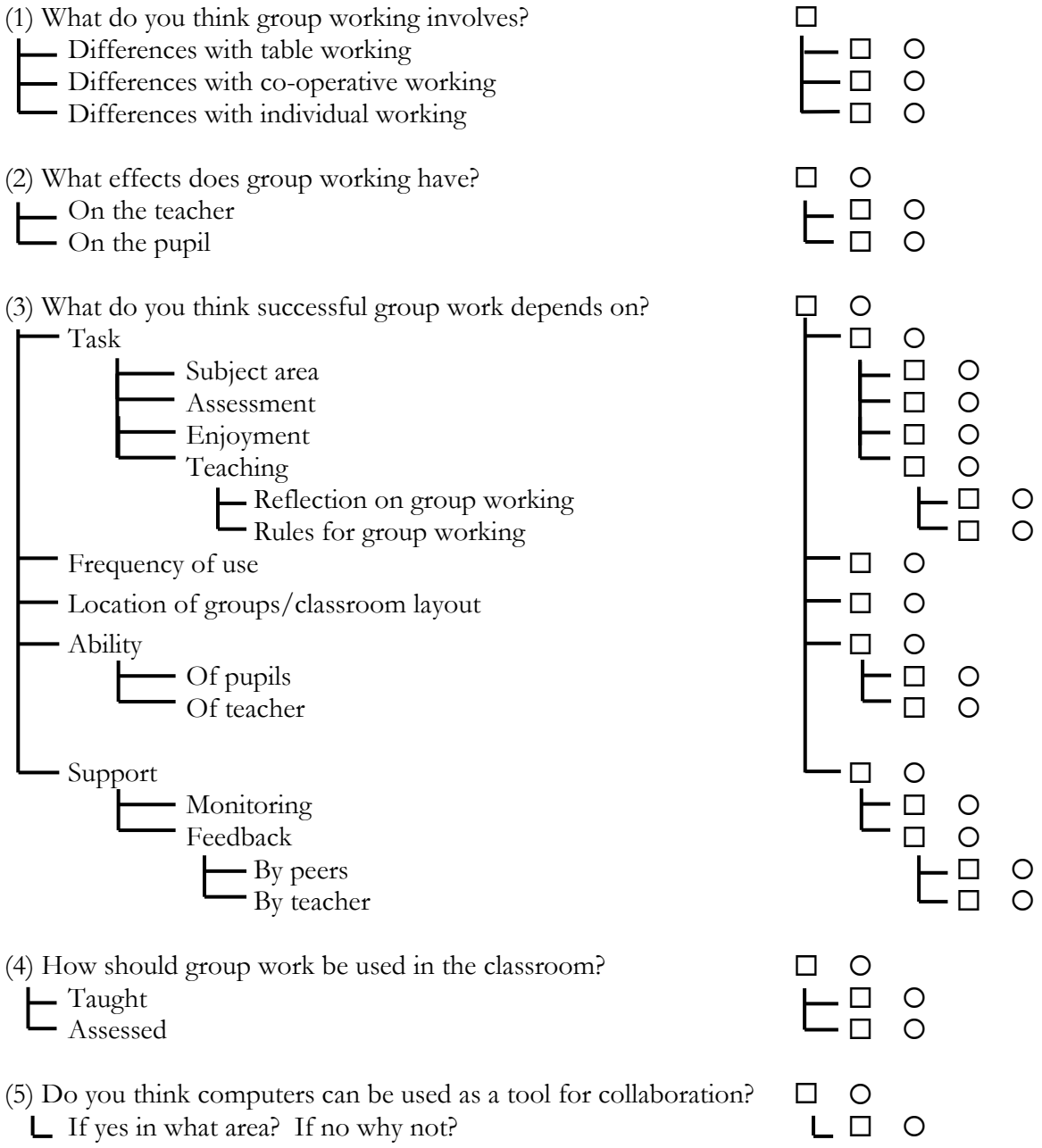
The main method for making these judgements was that the group should be watched. If squabbling or not sharing out jobs the group exercise was observed deemed to be unsuccessful.

APPENDIX E: TEACHER INTERVIEW AGENDA

This section contains the interview agenda for Study 1c. The interviews lasted 15 to 20 minutes, were conducted in private, and were recorded. Using this agenda ensured all the teachers considered the same areas, but enabled the researcher to record the free associations made by the teacher and did not restrict the order of answering.

○ Spontaneously answered

□ Prompted answer



Based on questionnaire format found in:

Tomlinson P (1989) Having it Both Ways: hierarchical focusing as research interview method. *British Educational Research Journal*, Vol. 15, No. 2, pp.155-176

APPENDIX F: SAT AND QCA COMPARISON

The Standard Assessment Tests (SATs) are examinations taken at the end of year 4 and year 6. Table F1 shows the results from children who participated in Studies 2, 3a, and 4a, and both the National and Birmingham area average. School X, the Church of England school, was ranked 25 out of the 276 junior schools within the Birmingham, England district. While School Y, the city school, was ranked 189. Combined the scores for mathematics and English are similar to the National Average, however, the children are better at science than the majority of children this age.

	SCHOOL X	SCHOOL Y	NATIONAL AVERAGE	AREA AVERAGE
MATHEMATICS	88	50	71	67.1
SCIENCE	98	89	87	67.1
ENGLISH	90	61	75	70.7

Table F1: QCA exam results from 2001

The Qualifications and Curriculum Authority (QCA) provide examinations in spelling, reading, written English, written and mental mathematics. Although not used by the school league tables they are important to indicate the effectiveness of literacy and numeracy teaching. National averages are published on the Internet so comparisons can be made (http://www.qca.org.uk/ca/tests/y345/).

The marks in these papers from 2001 and the National Averages are shown in Table F2. The children whose scores are given participated in Studies 1d, 1e, 3, 4b, 5 and 6. School X did not take the written English paper. The level is proportional to ability, i.e., a higher level indicates the child is more able. Children in School X are better on average in all subjects than School Y, and are significantly so in spelling ($p>0.05$ using a t-test), where they are above the National Average.

QCA LEVELS	<3	3			4			5+
		3C	3B	3A	4C	4B	4A	
ENGLISH (SPELLING)								
National Average	27.28%	-	47.96%	-	-	18.92%	-	5.84%
School X	18.18%	-	52.73%	-	-	29.09%	-	
School Y	21.28%	-	70.21%	-	-	6.38%	-	2.13%
ENGLISH (READING)								
National Average	20.80%	9.00%	13.35%	12.85%	16.31%	11.80%	9.71%	6.18%
School X	31.03%	5.17%	18.97%	5.17%	15.52%	8.62%	8.62%	6.90%
School Y	18.37%	16.33%	14.29%	20.41%	18.37%	4.08%	6.12%	2.04%
ENGLISH (WRITTEN)								
National Average	24.15%	16.14%	24.44%	11.53%	8.38%	11.10%	2.70%	1.56%
School Y	52.08%	6.25%	20.83%	12.50%	4.17%	4.17%		
MATHEMATICS (WRITTEN)								
National Average	21.59%	14.19%	14.60%	11.03%	14.70%	13.14%	7.93%	2.82%
School X	25.42%	11.86%	15.25%	10.17%	6.78%	18.64%	8.47%	3.39%
School Y	21.28%	21.28%	19.15%	6.38%	23.40%	6.38%	2.13%	0.00%

Table F2: Comparison of QCA scores

Table F3 is a comparison of the mental arithmetic scores from the same exam taken by both schools. These were not given in the summary of the National Average of QCA scores as they are used as part of the forecast for the Key Stage 2 mathematics exam. They show that a significant number of children from School X are better at mental arithmetic ($p>0.02$ using a t-test). Again a higher level indicates a higher ability.

MATHEMATICS (MENTAL)	<20%	21-30%	31-40%	41-50%	51-60%	61-70%	71-80%	80%+
SCHOOL X	10.53%	5.26%	19.30%	17.54%	14.04%	5.26%	12.28%	15.79%
SCHOOL Y	8.70%	21.74%	17.39%	19.57%	19.57%	6.52%	0.00%	6.52%

Table F3: Comparison of the mental arithmetic test scores

APPENDIX G: REASONS AND RULES FOR GROUP WORK

In all these School X refers to the Church of England Junior School, and School Y the city school. Both schools are in Birmingham, England. All mentions were made verbally and categorised from session recordings. The average group size of the 9 and 10 year olds was four.

The session was a structured interview with three question areas:

- How are groups used in school?
- Why work as groups?
- What rules would you give an alien who had just landed on earth for working well in a group?

This section contains:

- G1, which summarises the subjects and the group size that those subjects are taught in

- G2, which summarises the reasons children feel that they do group work, for example, it enables you to help others, they can help you etc. Each occurrence of a rule is recorded once per group, regardless of the number of times mentioned by the children

- G3, which is a summary of the rules given for working well together. Again, the number of occurrences relates to the number of groups that mentioned it, rather than the number of pupils

- G4, which is a summary of the rules given for working together as part of Study 4b. This tested the impact of using the Developing and Supporting Group Skills v2 model with paper as the medium. This occurred two terms after the rules given in G3 and was used to corroborate the previous suggestions

G1. Subjects and group size in current classroom practice according to pupils

School X

GROUP	PHYSICAL EDUCATION	COMPUTERS	GEOGRAPHY	ENGLISH	MATHE-MATICS	SCIENCE	DESIGN TECH.
1	2	2-3(p)	4-6(t)	4-6(t)	classes		
2	2	2(p)	2	2	2		2
3	2-3(p)	2-3		3-7(t)	classes		2
4	2	2(p)					2
5		2		2	Not		2
6	5-a-side	2(p)		6-7(t)	Only 1 class		3-4
7				6-7(3)			3-4
8		2				4-7(t)	3-4
9							
10	3-6	2	2(2)	5-7(t)	classes		2-3
11	2	2(1)			2-3	8(4)	2-3

School Y

GROUP	PHYSICAL EDUCATION	COMPUTERS	GEOGR-APHY	ENGLISH	MATHE-MATICS	SCIENCE	ART	HISTORY
1	2-11	2	4-6(t)	4-6	2	2-4		
2	2	2(p)		6-7	classes		4-6	
3	2-6	2(p)		4-6		4		
4		2(p)		4-6	classes	4-6		
5		2(p)	4-6(t)	2-3				4-6(t)
6	2-6	2				5-6	6	
7	2	2		6			1-6	
8		2(p)				4-5		
9	5	2(p)		5(t)	classes			
10				2-3				
11		2		6		2		
12		2(p)	4(t)	2-3	classes	5-6		

KEY

(t) = tables

(p) = prompted by researcher

(1) = not enough equipment

(2) = not enough atlases

(3) = grouped according to a colour scheme, indigo, red, green etc.

G2. Quantitative results of reasons for group work

REASONS FOR GROUP WORK	SCHOOL X (11 GROUPS)		SCHOOL Y (12 GROUPS)		TOTAL	
	Freq.	%	Freq.	%	Freq.	%
Can help others	6	*17.14%*	4	*9.76%*	10	*13.16%*
You do better work	5	*14.29%*	3	*7.32%*	8	*10.53%*
Others can help you	2	*5.71%*	4	*9.76%*	6	*7.89%*
To make friends	5	*14.29%*			5	*6.58%*
It's faster	1	*2.86%*	4	*9.76%*	5	*6.58%*
Share or get ideas	2	*5.71%*	2	*4.88%*	4	*5.26%*
To get use to working with people	2	*5.71%*	2	*4.88%*	4	*5.26%*
Tell each other the answers	1	*2.86%*	3	*7.32%*	4	*5.26%*
Can talk more	2	*5.71%*			2	*2.63%*
Improves or teaches communication skills			2	*4.88%*	2	*2.63%*
So you can be stupid or mess around	1	*2.86%*	1	*2.44%*	2	*2.63%*
It's easier	1	*2.86%*	1	*2.44%*	2	*2.63%*
You learn to share things			2	*4.88%*	2	*2.63%*
You work harder			1	*2.44%*	1	*1.32%*
You think for yourself			1	*2.44%*	1	*1.32%*
You can be loud	1	*2.86%*			1	*1.32%*
You don't have to do as much work	1	*2.86%*			1	*1.32%*
You can talk about it before writing things down			1	*2.44%*	1	*1.32%*
It's never bad to have to work together	1	*2.86%*			1	*1.32%*
Share skills			1	*2.44%*	1	*1.32%*
To see how other people are getting on			1	*2.44%*	1	*1.32%*
To be kind to each other			1	*2.44%*	1	*1.32%*
To stop things going wrong	1	*2.86%*			1	*1.32%*
It's fun	1	*2.86%*			1	*1.32%*
You can work with friends	1	*2.86%*			1	*1.32%*
You won't get into trouble			1	*2.44%*	1	*1.32%*
You learn to help			1	*2.44%*	1	*1.32%*
It makes you clever			1	*2.44%*	1	*1.32%*
It stops you fighting			1	*2.44%*	1	*1.32%*
If a meteor crashed into earth you would know how to stop it			1	*2.44%*	1	*1.32%*
Your group can teach you things	1	*2.86%*			1	*1.32%*
You can get help on spellings			1	*2.44%*	1	*1.32%*
Because you learn a lot			1	*2.44%*	1	*1.32%*
TOTAL CONTRIBUTIONS	35	*100%*	41	*100%*	76	*100%*

G3. Quantitative results for rules for working well together

RULES FOR GROUP WORK	SCHOOL X (11 GROUPS)		SCHOOL Y (12 GROUPS)		TOTAL	
	Freq.	*Percentage*	Freq.	*Percentage*	Freq.	*Percentage*
Help each other, Give advice	7	*14.29*	5	*10.42*	12	*12.37*
Share ideas or thoughts or skills	5	*10.20*	3	*6.25*	8	*8.25*
Be nice (no nastiness - teasing), Don't annoy, Be kind, Don't be angry	4	*8.16*	4	*8.33*	8	*8.25*
Listen	2	*4.08*	5	*10.42*	7	*7.22*
Talking, Discussing, Communicate, Talk it through first	4	*8.16*	3	*6.25*	7	*7.22*
Work together - do stuff together	3	*6.12*	4	*8.33*	7	*7.22*
Be friends, Get along with each other, Don't act as boss, Know the people			6	*12.50*	6	*6.19*
Co-operate	2	*4.08*	3	*6.25*	5	*5.15*
Don't argue, Agree	1	*2.04*	4	*8.33*	5	*5.15*
Get helped	3	*6.12*	1	*2.08*	4	*4.12*
Be sensible	4	*8.16*	0		4	*4.12*
Share things	1	*2.04*	2	*4.17*	3	*3.09*
Work things out, Compromise	1	*2.04*	2	*4.17*	3	*3.09*
Concentrate, Try hard	3	*6.12*			3	*3.09*
Listen to teacher	3	*6.12*			3	*3.09*
Take turns			2	*4.17*	2	*2.06*
Both do it, more than one person			2	*4.17*	2	*2.06*
Be good (not naughty)	1	*2.04*	1	*2.08*	2	*2.06*
Be quiet and whisper	2	*4.08*			2	*2.06*
Argue			1	*2.08*	1	*1.03*
Tell teacher if partner naughty	1	*2.04*			1	*1.03*
Get on with work	1	*2.04*			1	*1.03*
Put your hand up	1	*2.04*			1	*1.03*
TOTAL CONTRIBUTIONS	49	*100*	48	*100*	97	*100*

G4. Rules from Study 4b corroborating Study 1e

The participants are the children in School X. Group D had used the Aliens software, based on the Developing and Supporting Group Skills (DSGS) v2 model described in Chapter 5 for 18 weeks. Group C, the control group, had been given no extra support to work together. At the beginning of their ICT lesson in Study 4b all the children were asked to work with their partner and agree three rules necessary to work well together and write these on a special form.

The children in Group D had seen the following rules for the previous 18 sessions:

> Do not cheat
> Take turns
> Listen to each other
> Make sure you both understand
> Agree before you perform an action

Exposure to these appeared to impact Group D's choice of rules for successful group work. The majority of their chosen rules, 69.05%, fall into these categories. Pairs from Group D suggested rules relating to understanding and not cheating, which were not mentioned in Study 1e or by Group C. Those in Group C, however, gave a wider range of rules and include a variation of not fighting. This rule was given in Study 2 but not by the children who used the DSGS v2 model. The rules given overlap, but the number of different rules is not as extensive as in Study 1. This is probably due to each pair only having to provide three rules. The table below organises the rules written on the record sheet into similar categories.

GROUP D (14 PAIRS)				**GROUP C (10 PAIRS)**			
RULES	Subtotal	Total per category	Percentage	**RULES**	Subtotal	Total per category	Percentage
Listen to each other	7			listening to each other	2		
				Listen to what each other has to say	1		
				Listen to your partner	1		
				Listen to each other	1		
		7	*16.67*	Don't interupet when your partner is talking	1	6	*20.00*
talk before we do something	1			Communication	1		
				talk together	2		
				Say what you think to your partner	1		
				Read the instructions and discuss	1		
		1	*2.38*	Ask and share opinoins	1	6	*20.00*
take turns	7			take turns	1		
make sure we both have a turn	1			we take turn on the computer	1		
		8	*19.05*	take it in turns to do different things	1	3	*10.00*
Swop over regually	1			share the mouse	1		
swop over mouse + keyboard	1	2	*4.76*	Share everything (mouse, keyboard and ideas)	1	2	*6.67*
Agree before you perform an action	3			decide things together before doing them	1		
agree with each others desicions	1	4	*9.52*	agreeing with each other	1	2	*6.67*
make sure you understand	2						
make sure you both understand	2						
Make sure we both understand	1	5	*11.90*				
give each other ideas	1			we share Ideas with one and another	1		
		1	*2.38*	use both your ideas	1	2	*6.67*

GROUP D (14 PAIRS)				**GROUP C (10 PAIRS)**			
RULES	Subtotal	Total per category	Percentage	**RULES**	Subtotal	Total per category	Percentage
Work together	3			Working together (sharing)	1		
Work well together	1			Cooperation	1		
		4	*9.52*	Share the work	1	3	*10.00*
help each other	1	1		Help each other	1		
			2.38	Helping each other	2	3	*10.00*
Follow the instructions	1	1	*2.38*				
Don't cheat	4						
Ignore any answers from other people	1	5	*11.90*				
do not mess about	1			We don't fight we just work together	1		
Don't be silly	1	2		don't fall out	1		
			4.76	we don't moan at each other	1	3	*10.00*
work, work, work, work, work	1	1	*2.38*				
TOTAL CONTRIBUTIONS	42	42	*100*		30	30	*100*

APPENDIX H: THE GENERATION OF FEEDBACK IN STUDY 2

This section describes the heuristics to generate feedback for The Escape from the Forbidden Forest puzzle in Study 2. For pairs it evaluates the amount of group work displayed. For the individual condition, it evaluates the difficulty of the problem.

The three parts correspond to the three conditions:

- H1 describes the heuristic for supported pairs – these children used software with dual-key control and the DSGS v1 model

- H2 describes the heuristic for non-supported pairs – these children used software with dual-key control

- H3 describes the heuristic for individuals – these children worked alone throughout, not just when solving the puzzle at the end after practicing in pairs as in the other conditions

Each section explains how the feedback, that is the numeric value and the corresponding final screen statements were generated. The three prompts are an initial question ("prompt") on why the answers were given, as recommended in Study 1c praise ("praise message"), and if necessary a final prompt focusing on future behaviour ("final question").

The Escape from the Forbidden Forest comprises of two problems. The first has four trees and four characters and corresponds to the Tower of Hanoi puzzle with four rods and four rings. The second has three trees and four characters and corresponds to the Tower of Hanoi puzzle with three rods and four rings.

The characters to be rescued are Tabitha and Bloomsbury in the conditions for pairs, and Tabitha, Bloomsbury and Tom in the individual condition.

H1. Feedback generated for supported pairs

This formula produced a score similar to that given by teachers observing videos of children from the design phase of The Escape from the Forbidden Forest puzzle. The puzzle is performed by two children: Player1 and Player2.

The computer collects the following information:

FOR FIRST PUZZLE (4 TREES)

4Counter = total number of moves taken while practicing the puzzle

4NoReminders = the number of reminders for rules

4RuleCounter = the number of rules pressed

Player1Score4, Player2Score4 = the number of turns taken for 4 trees when working individually

FOR SECOND PUZZLE (3 TREES)

3Counter = total number of moves taken while practicing the puzzle

3NoReminders = the number of reminders for rules

3RuleCounter = the number of rules pressed

Player1Score3, Player2Score3 = the number of turns taken for 3 trees when working individually

Bonus scores for similar task performance

if Player1Score4 = Player2Score4	$bonus4 = 5$
if abs(Player1Score4 - Player2Score4) < 3	$bonus4 = 3$
if abs(Player1Score4 - Player2Score4) < 6	$bonus4 = 1$
else	$bonus4 = 0$

If the puzzle with three trees has been attempted:

if Player1Score3 = Player2Score3	$bonus3 = 5$
if abs(Player1Score3 - Player2Score3) < 3	$bonus3 = 3$
if abs(Player1Score3 - Player2Score3) < 6	$bonus3 = 1$
else	$bonus3 = 0$

Heuristic

$$Computer\ \ group\ score\ \ for\ \ puzzle\ 4 = \left(\frac{(Rule4Counter * 100)}{4Counter} * \frac{(4RuleCounter - 4NoReminders)}{4Counter} \right) + bonus4$$

If the puzzle with three trees has been attempted:

$$Computer\ \ group\ score\ \ for\ \ puzzle\ 3 = \left(\frac{(Rule3Counter * 100)}{3Counter} * \frac{(3RuleCounter - 3NoReminders)}{3Counter} \right) + bonus3$$

The *Computer group score* is the value returned to the pair of children after completing the puzzle:

If *Computer group score for puzzle 3* > 0 then

$$\textit{Computer group score} = \frac{\textit{Computer group score puzzle 3} + \textit{Computer group score puzzle 4}}{2}$$

else

$$\textit{Computer group score} = \textit{Computer group score puzzle 4}$$

Final screen statements

Own group score = the self-assessment on how well they worked together overall, with 0 being not at all, and 100 being all the time

if (*Own group score* - *Computer group score*) > 10
    set prompt = "Why do you think that your own mark is <(*Own group score* – *Computer group score*)> higher than the computer calculated?"
if (*Computer group score* - *Own group score*) > 10 then
    set prompt = "Why do you think that your own mark is < (*Computer group score* – *Own group score*)> lower than the computer calculated?"

if *Computer group score* > 75 then
    set praise message = "Congratulations, you and the computer agree that you can work well together."
if *Computer group score* > 50 then
    set praise message = "You and the computer seem to agree you work quite well together, but it could be better."
else
    set praise message = "Hmmm, perhaps you ought to show the computer you can work better next time."

if *Own group score* > 90 and *Computer group score* > 90 then
    set final question = "You worked well together, remember to think about what you did today when you work together in the future."
else
    set final question = "Before you go back to class agree what you will do better next time when you have to work together."

Example

The following illustrates how feedback would be calculated. In this example the children only practiced three times before individually solving the puzzle and do not attempt the puzzle with three trees.

	NO OF MOVES (4COUNTER)	NO OF REMINDERS (4NOREMINDERS)	NO OF TIMES RECORDED A RULE WAS FOLLOWED (4RULECOUNTER)
Practice 1	27	5	16
Practice 2	17	2	20
Practice 3	12	3	18
Total	*56*	*10*	*54*

Number of moves to solve the four tree puzzle:

Player1Score4 = 12
Player2Score4 = 11

Own group score = 77

The bonus score is:

abs(Player1Score4 - Player2Score4)
= abs(12-11)
= 1 therefore *bonus4* = 3

Substituting into the heuristic:

$$Computer\ group\ score\ for\ puzzle\ 4 = \left(\frac{(Rule4Counter * 100)}{gCounter} * \frac{(4RuleCounter - 4NoReminders)}{4RuleCounter} \right) + bonus4$$

$$= \left(\frac{(54 * 100)}{56} * \frac{(54 - 10)}{54} \right) + 3$$

$$= \left(\frac{3{,}200}{56} * \frac{44}{54} \right) + 3$$

$$= 82$$

As *Computer group score for puzzle 3* = 0 then

$$Computer\ group\ score\ =\ Computer\ group\ score\ puzzle\ 4$$

= 82%

The numeric value returned for the amount of group work occurring is 82%.

Final screen statements:

Prompt = Why do you think that your own mark is 5% lower than the computer calculated?
Praise message = Congratulations, you and the computer agree that you can work well together.

Final question = Before you go back to class agree what you will do better next time when you have to work together.

H2. Feedback generated for non-supported pairs

This formula produced a score on the level of group work based purely on the similarity of the number of moves needed to solve The Escape from the Forbidden Forest without assistance after the practice. The puzzle is performed by two children: Player1 and Player2.

FOR FIRST PUZZLE (4 TREES)
Player1Score4, Player2Score4 = the number of turns taken for 4 trees when working individually

FOR SECOND PUZZLE (3 TREES)
Player1Score3, Player2Score3 = the number of turns taken for 3 trees when working individually

Heuristic

If Player1Score4 = Player2Score4	*score4* = 95
if abs(Player1Score4 - Player2Score4) = 1	*score4* = 80
if abs(Player1Score4 - Player2Score4) = 2	*score4* = 65
if abs(Player1Score4 - Player2Score4) = 3	*score4* = 50
if abs(Player1Score4 - Player2Score4) = 4	*score4* = 35
if abs(Player1Score4 - Player2Score4) = 5	*score4* = 20
if abs(Player1Score4 - Player2Score4) = 6	*score4* = 5
else	*score4* = 0

If the puzzle with three trees has been attempted:

if Player1Score3 = Player2Score3	*score3* = 5
if abs(Player1Score3 - Player2Score3) = 1	*score3* = 80
if abs(Player1Score3 - Player2Score3) = 2	*score3* = 65
if abs(Player1Score3 - Player2Score3) = 3	*score3* = 50
if abs(Player1Score3 - Player2Score3) = 4	*score3* = 35
if abs(Player1Score3 - Player2Score3) = 5	*score3* = 20
if abs(Player1Score3 - Player2Score3) = 6	*score3* = 5
else	*score3* = 0

If *score 3* > 0 then

$$Computer\ group\ score = \frac{score\ 3 + score\ 4}{2}$$

else

$$Computer\ group\ score = score\ 4$$

Final screen statements

Own group score = the self-assessment on how well they worked together, with 0 being not at all, and 100 being all the time

if (*Own group score* – *Computer group score*) > 10 then
    set prompt = "Why do you think that your own mark is <(*Own group score* - *Computer group score*) higher than the computer calculated?"
if (*Computer group score* - *Own group score*) > 10 then
    set prompt = "Why do you think that your own mark is <(*Computer group score* - *Own group score*)> lower than the computer calculated?"

if *Computer group score* > 75 then
    set praise message = "Congratulations, you and the computer agree that you can work well together."
if *Computer group score* > 50 then
    set praise message = "You and the computer seem to agree you work quite well together, but it could be better."
else
    set praise message = "Hmmm, perhaps you ought to show the computer you can work better next time."

if *Own group score* > 90 and *Computer group score* > 90 then
    set final question = "You worked well together, remember to think about what you did today when you work together in the future."
else
    set final question = "Before you go back to class agree what you will do better next time when you have to work together."

Example

The following illustrates how feedback would be calculated.

Number of moves to solve the four tree puzzle:

Player1Score4 = 12
Player2Score4 = 11
Player1Score3 = 22
Player2Score3 = 25

Own group score = 90

The scores:

abs(Player1Score4 - Player2Score4)
= abs(12 – 11)
= 1 therefore *score4* = 80

abs(Player1Score3 - Player2Score3)
= abs(22 – 25)
= 3 therefore *score3* = 65

Substituting into the heuristic:

$$Computer\ group\ score = \frac{score\ 3 + score\ 4}{2}$$

$$= \frac{80 + 65}{2}$$

$$= 72.5$$

The numeric value returned for the amount of group work occurring is 73%.

Final screen statements:

Prompt =	Why do you think that your own mark is 17% higher than the computer calculated?
Praise message =	You and the computer seem to agree you work quite well together, but it could be better

H3. Feedback generated for individuals

This formula produced a score on the complexity of the puzzle based on the children's performance at the puzzle when performing it after practicing. This was contrasted with their own belief on how difficult it was to solve.

FOR FIRST PUZZLE (4 TREES)
Player1Score4 = the number of turns taken for 4 trees when performing the final escape
The least number of moves is 9

FOR SECOND PUZZLE (3 TREES)
Player1Score3 = the number of turns taken for 4 trees when performing the final escape
The least number of moves is 15

Heuristic

if Player1Score4 = 9	*score4* = 95
if abs(Player1Score4 - 9) = 1	*score4* = 80
if abs(Player1Score4 - 9) = 2	*score4* = 65
if abs(Player1Score4 - 9) = 3	*score4* = 50
if abs(Player1Score4 - 9) = 4	*score4* = 35
if abs(Player1Score4 - 9) = 5	*score4* = 20
if abs(Player1Score4 - 9) = 6	*score4* = 5
else	*score4* = 0

If the puzzle with three trees has been attempted:

if Player1Score3 = 15	*score3* = 95
if abs(Player1Score3 - 15) = 1	*score3* = 80
if abs(Player1Score3 - 15) = 2	*score3* = 65
if abs(Player1Score3 - 15) = 3	*score3* = 50
if abs(Player1Score3 - 15) = 4	*score3* = 35
if abs(Player1Score3 - 15) = 5	*score3* = 20
if abs(Player1Score3 - 15) = 6	*score3* = 5
else	*score3* = 0

if *score 3* > 0 then

$$\textit{Computer difficulty score} = \frac{\textit{score 3} + \textit{score 4}}{2}$$

else

$$\textit{Computer difficulty score} = \textit{score 4}$$

Final screen statements

Own difficulty score = the self-assessment on the difficulty of the puzzle with 0 being very hard, and 100 being very easy

if (*Own difficulty score* – *Computer difficulty score*) > 15 then
    set prompt = "The computer thought your skill at escaping would mean you found it easier. So well done for escaping better than you thought!"
if (*Own difficulty score* – *Computer difficulty score*) > 15 then
    set prompt = "Hmmmm - the computer thought you had difficulty escaping and is surprised you thought it was that easy."
else
    if *Computer difficulty score* > 50 then
        set prompt = "Given how well you escaped the computer thinks your idea of how hard it was is about right."
    else
        set prompt = "Given how well you escaped the computer thinks your idea of how easy it was is about right."

if (Player1Score4 < 12) then
    set praise message = "Congratulations again for being excellent! Tabitha, Bloomsbury and Tom are glad you lead the escape."
if (Player1Score4 < 15) then
    set praise message = "Tabitha, Bloomsbury and Tom think you were really good at leading the escape."
else
    set praise message = "Well done for escaping, but next time you need to be a bit faster!"

Example

In this example the child has only completed the first puzzle, that of four trees.

Number of moves to solve the four tree puzzle:

Player1Score4 = 12

Own difficulty score = 82

The scores are:

abs(Player1Score4 - 9)
= abs (12 – 9)
= 3 therefore *score4* = 50

Substituting into the heuristic:

Computer difficulty score = *score* 4

= 50

The numeric value returned for difficulty of the problem is 50%.

Final screen statements:

Prompt =	Hmmmm - the computer thought you had difficulty escaping and is surprised you thought it was that easy.
Praise message =	Tabitha, Bloomsbury and Tom think you were really good at leading the escape.

APPENDIX I: EVALUATION QUESTIONNAIRES FROM STUDY 2

This section contains the three questionnaires used to evaluate The Escape from the Forbidden Forest puzzle given in Study 2, the justification for the questionnaire and the summary of main findings. The questionnaire's structure and contents are identical to those distributed but it has been scaled down to fit these pages. The identifiers in the top right corner did not appear on the copies given to children.

- I1 is the questionnaire for supported pairs
- I2 is the questionnaire for non-supported pairs
- I3 is the questionnaire for individuals
- I4 gives the justification for each question in the supported pairs questionnaire, the information was gathered to confirm the existing design, and how it could be improved
- I5 summarises the findings from the questionnaires

I1. Questionnaire for supported pairs

Escape from Forbidden Forest

"Escape from Forbidden Forest" is the first stage of my project. To help me design the next part I would like your help. By answering these questions I will learn what you thought was good or bad about the game which means the next one will be better.

Please circle the answer that matches your feelings most, or write in the box. I will not know who wrote what so do not copy the person next to you or choose what you think your teachers or I would like to see but be truthful.

Please circle the one that is correct.

You: Boy Girl **Partner:** Boy Girl

The game					
Did the pictures encourage you to play this game?	A lot more	A bit more	No difference	A bit less	A lot less
Were the pictures helpful in understanding the problem and escaping?	Very helpful	Helpful	No effect	Not helpful	Did not help at all
Did the sounds encourage you to play this game?	A lot more	A bit more	No difference	A bit less	A lot less
How useful were the sounds?	Very helpful	Helpful	No effect	Not helpful	Did not help at all
Did the story encourage you to play this game?	A lot more	A bit more	No difference	A bit less	A lot less
What did you think of the story length?	Too long	A bit long	Just right	A bit short	Too short
Did the story help you understand the problem?	Helped a lot	Helped a bit	No effect	Confused a bit	Confused a lot
Did you understand the game instructions?	Very well	Well	Enough to play	A bit	Not at all
Were the explanations when you made a mistake?	Very helpful	Helpful	Made no difference	Confusing	Very confusing
Did having lives make you plan your moves more carefully?	A lot more	A bit more	No difference	A bit less	A lot less
What did you think of the level of difficulty of the escapes?	Too easy	Easy	About right	Hard	Too hard

Please turn over

Working together					
How much working together do you normally do when on a computer?	You always agree what to do together first	You usually agree what to do together first	You take turns and sometimes help your partner	You take turns and only help your partner if they ask you	You take turns but never help when it is your partner's turn
How much working together did you do when trying to escape together?	You always agreed what to do together first	You usually agreed what to do together first	You took turns and sometimes helped your partner	You took turns and only helped your partner if they asked you	You took turns but never helped when it was your partners turn
How would you describe your partner?	A good friend	A friend	You get on OK	You do not like each other	You *really* do not like each other
Did you agree with your partner before clicking on the 3 rules you chose?	Always	Most of the time	About half the time	Only some of the time	Never
Did you help your partner when they were escaping alone?	Not at all	A little	About half the time	A lot	You did it for them
Did being asked to explain the next moves help you develop a plan for escaping?	It slowed you down a lot	It slowed you down a bit	No effect	It helped a bit	It helped a lot
Did sharing the mouse and keyboard mean you thought about working together?	A lot more	A bit more	No difference	A bit less	A lot less
Did having the 3 rules about working together mean you thought about it more?	A lot more	A bit more	No difference	A bit less	A lot less
Write down any more rules you think need to be added to the list for working together:					

Enjoyment					
What did you think of the game overall?	Good fun	Fun	OK	A bit boring	Very boring
Would you play it again?	Yes		No		
How could the game be made better?  **Thank you for your help**					

I2. Questionnaire for non-supported pairs

Escape from Forbidden Forest

"Escape from Forbidden Forest" is the first stage of my project. To help me design the next part I would like your help. By answering these questions I will learn what you thought was good or bad about the game which means the next one will be better.

Please circle the answer that matches your feelings most, or write in the box. I will not know who wrote what so do not copy the person next to you or choose what you think your teachers or I would like to see but be truthful.

Please circle the one that is correct.

You: Boy Girl **Partner:** Boy Girl

The game					
Did the pictures encourage you to play this game?	A lot more	A bit more	No difference	A bit less	A lot less
Were the pictures helpful in understanding the problem and escaping?	Very helpful	Helpful	No effect	Not helpful	Did not help at all
Did the sounds encourage you to play this game?	A lot more	A bit more	No difference	A bit less	A lot less
How useful were the sounds?	Very helpful	Helpful	No effect	Not helpful	Did not help at all
Did the story encourage you to play this game?	A lot more	A bit more	No difference	A bit less	A lot less
What did you think of the story length?	Too long	A bit long	Just right	A bit short	Too short
Did the story help you understand the problem?	Helped a lot	Helped a bit	No effect	Confused a bit	Confused a lot
Did you understand the game instructions?	Very well	Well	Enough to play	A bit	Not at all
Were the explanations when you made a mistake?	Very helpful	Helpful	Made no difference	Confusing	Very confusing
Did having lives make you plan your moves more carefully?	A lot more	A bit more	No difference	A bit less	A lot less
What did you think of the level of difficulty of the escapes?	Too easy	Easy	About right	Hard	Too hard

Please turn over

Working together					
How much working together do you normally do when on a computer?	You always agree what to do together first	You usually agree what to do together first	You take turns and sometimes help your partner	You take turns and only help your partner if they ask you	You take turns but never help when it is your partner's turn
How much working together did you do when trying to escape together?	You always agreed what to do together first	You usually agreed what to do together first	You took turns and sometimes helped your partner	You took turns and only helped your partner if they asked you	You took turns but never helped when it was your partners turn
How would you describe your partner?	A good friend	A friend	You get on OK	You do not like each other	You *really* do not like each other
Did you agree with your partner before moving a person?	Always	Most of the time	About half the time	Only some of the time	Never
Did you help your partner when they were escaping alone?	Not at all	A little	About half the time	A lot	You did it for them
Did you develop a plan for escaping before moving?	Never thought about next move	Sometimes thought about it	Planned one move ahead	Planned a few moves ahead	Planned all the moves before starting
Did sharing the mouse and keyboard mean you thought about working together more?	A lot more	A bit more	No difference	A bit less	A lot less
Enjoyment					
What did you think of the game overall?	Good fun	Fun	OK	A bit boring	Very boring
Would you play it again?	Yes			No	
How could the game be made better? 					

Thank you for your help

I3. Questionnaire for individuals

Escape from Forbidden Forest

"Escape from Forbidden Forest" is the first stage of my project. To help me design the next part I would like your help. By answering these questions I will learn what you thought was good or bad about the game which means the next one will be better.

Please circle the answer that matches your feelings most, or write in the box. I will not know who wrote what so do not copy the person next to you or choose what you think your teachers or I would like to see but be truthful.

Please circle the one that is correct.

You: Boy Girl

The game					
Did the pictures encourage you to play this game?	A lot more	A bit more	No difference	A bit less	A lot less
Were the pictures helpful in understanding the problem and escaping?	Very helpful	Helpful	No effect	Not helpful	Did not help at all
Did the sounds encourage you to play this game?	A lot more	A bit more	No difference	A bit less	A lot less
How useful were the sounds?	Very helpful	Helpful	No effect	Not helpful	Did not help at all
Did the story encourage you to play this game?	A lot more	A bit more	No difference	A bit less	A lot less
What did you think of the story length?	Too long	A bit long	Just right	A bit short	Too short
Did the story help you understand the problem?	Helped a lot	Helped a bit	No effect	Confused a bit	Confused a lot
Did you understand the game instructions?	Very well	Well	Enough to play	A bit	Not at all
Were the explanations when you made a mistake?	Very helpful	Helpful	Made no difference	Confusing	Very confusing
Did having lives make you plan your moves more carefully?	A lot more	A bit more	No difference	A bit less	A lot less
What did you think of the level of difficulty of the escapes?	Too easy	Easy	About right	Hard	Too hard

Please turn over

Managing an escape					
How much working together do you normally do when on a computer?	You always agree what to do together first	You usually agree what to do together first	You take turns and sometimes help your partner	You take turns and only help your partner if they ask you	You take turns but never help when it is your partner's turn
Did you help the people around you?	Never	They asked but you did not help	They asked and you helped a bit	They asked and you helped a lot	You helped but were not asked to
Did the people around help you?	Never	You asked but they did not help	You asked and they helped a bit	You asked and they helped a lot	They helped you but were not asked to
Did you develop a plan for escaping before moving?	Never thought about next move	Sometimes thought about it	Planned one move ahead	Planned a few moves ahead	Planned all the moves before starting
Enjoyment					
What did you think of the game overall?	Good fun	Fun	OK	A bit boring	Very boring
Would you play it again?	Yes		No		

How could the game be made better?

Thank you for your help

I4. Analysis of Supported pairs questionnaire

The following summarises why the questions to pairs using the DSGS v1 model were given, and how the information gathered was to be used.

The questionnaires were anonymous. This prevents a comparison between their attitudes towards "lives" and clarity of instructions, with performance. This limitation was introduced as this format should encourage the children to be honest, without fearing repercussions.

The gender was asked to corroborate a finding from the design sessions. In these most of the children, and especially the girl pairs, stressed the children would only work together if the pairs were of children of the same gender.

The game	
Did the pictures encourage you to play this game?	Aesthetics imply personal taste, more interested in the amount of graphics needed to enthuse pupils, assumed that animation etc., is encouraging and not distracting.
Were the pictures helpful in understanding the problem and escaping?	Concerned with problem representation, assumption is that pictures beneficial (NIMIS project).
Did the sounds encourage you to play this game?	Again not interested in aesthetics but does the sound, e.g., the scary sound motivates?
How useful were the sounds?	Could the children determine where they were through sounds – did they even think about them? Sounds used infrequently due to class size; want to know whether or not inclusion makes a difference.
Did the story encourage you to play this game?	Interested in type of scenario found motivating, does it appeal to boys and girls, extension of Joiner *et al.* (1988) work on problem type, predict that it should appeal to both.
What did you think of the story length?	Interested in amount of preamble to motivate children, also is the complexity related to performance.
Did the story help you understand the problem?	Again concerned with problem representation, really I need a comparison with children offered the problem directly; this relates back to Light and Glachan (1985) study.
Did you understand the game instructions?	Concerned with level of pitching and instruction location, visible from help, and when made mistake, corroborate with number of errors reported.
Were the explanations when you made a mistake helpful?	Level of detail in prompt – also necessity – is losing a life sufficient to work out where went wrong?
Did having lives make you plan your moves more carefully?	Again this is motivation, am curious as to what encourages children to play.
What did you think of the level of difficulty of the escapes?	Concerned with level of difficulty for children this age.

Working together	
How much working together do you normally do when on a computer?	Background information for comparison.
How much working together did you do when trying to escape together?	To determine success of game - should corroborate evidence from game itself.
How would you describe your partner?	In development children insistent that would only work if you played with a friend, am confirming this theory.
Did you agree with your partner before clicking on the rules you chose?	Am not sure of the honesty of their answers, but need to know whether they discussed the use of rules or if it was unilaterally assumed.
Did you help your partner when they were escaping alone?	Again dependent on honesty, but need to know if they worked together and memorised solution.
Did being asked to explain the next moves help you develop a plan for escaping?	Am interested in knowing whether they felt that they had a clearer idea of what to do when being asked to talk about it. Almost testing for exploratory conversation, but feel that asking how much they talked is not directly beneficial, as have no comparison.
Did sharing the mouse and keyboard mean you thought about working together?	Trying to divide how much of the working together was based on dual key and problem, and how much was directly influenced by the rules.
Did having the 3 rules about working together mean you thought about it more?	Trying to determine the impact of reflection on behaviour at the start of the task.
Write down any more rules you think need to be added to the list for working together:	This is just to extend my database of rules for working together, it will be corroborated by any rules they enter themselves.
Enjoyment	
What did you think of the game overall?	This is just to get a feel for their opinion, whether or not the general format of the puzzle is right.
Would you play it again?	Trying to determine life span of puzzle.

How could the game be made better?

Looking for general comments and suggestions not given by those involved in design.

Thank you for your help

I5. Summary of questionnaire findings

Chi square tests were used to check for significance in the questionnaire results. All the conditions felt the story, pictures, sounds, instructions, explanations, and having lives benefited the puzzle, and the difficulty level was appropriate ($p>0.1$ to $p>0.001$). The only two non-significant findings were from individuals referring to the instructions and explanation. Those with partners believed that they worked together well usually, and on this escape ($p>0.001$). They were more likely to be good friends or friends ($p>0.001$). A significant amount from both groups said they helped their partner ($p>0.01$) when they were suppose to be working alone, and people who had worked alone throughout also said they had help from others ($p>0.05$). Boys found being asked being asked to make a plan helped them ($p>0.01$), whereas this did not affect the girls in supported software. Using unsupported software more boys than girls said they made a plan - although both said they did a significant amount of the time ($p>0.01$, $p>0.05$ respectively). Both unsupported and supported pairs said the dual key control was beneficial ($p>0.001$). Girls found having to declare rules helped them to think about working together more than boys although significant for both (girls $p>0.001$, boys $p>0.02$). Two rules were suggested, "not to fight", and "explain to your partner".

The puzzle was more popular with girls but the majority of children from all categories enjoyed it and would play again, as shown in the table below.

	Number that would:	All		Boys		Girls	
Supported	Play again	34	*70.83%*	16	*64.00%*	18	*78.26%*
	Not play again	14	*29.17%*	9	*36.00%*	5	*21.74%*
Unsupported	Play again	46	*76.67%*	21	*67.74%*	25	*86.21%*
	Not play again	14	*23.33%*	10	*32.26%*	4	*13.79%*
Individual	Play again	17	*77.27%*	10	*71.43%*	7	*87.50%*
	Not play again	5	*22.73%*	4	*28.57%*	1	*12.50%*

Finally, although the puzzle was declared good one boy felt it could be improved: "I would like shooting in it and monsters a more grafics and pictures".

There were four mixed pairs in total, two from each condition, only one boy in a non-supported pair would not play it again and said "it was a bit boring". The others said it was fun or good fun. This is not a significant enough number to decide whether the opinion of those designing the software was correct, but would indicate it is context based, and dependent on existing friendships, those around them etc.

APPENDIX J: CONTROL SAMPLE LESSON PLANS

This section contains the lesson plans given to the teachers that were used within Study 4b for those in the control group, the corroboration of the impact of medium on self-assessment. Those using Aliens were given extra time as the children were stopped approximately five times by the application to assess performance at one of their chosen criteria during the task and then had three minutes at the end to reflect on their group skill usage in Lesson 4. These lessons fulfil the ICT Control topic, which is part of the National Curriculum (DfES 2000). They are based on Unit 5E in the Department for Education and Skills Scheme of Work for Year 5 ICT (DfES 2001) and incorporate ideas from the Lego Dacta™ Teacher Notes.

The study took place in weeks 18 and 19. Group D, those using the DSGS v2 model, performed lesson 4 on robots in the first week using the Aliens software to record their self-assessments. Group C and D performed Lesson 5 the following week. Both used the DSGS v2 model, but recorded their opinions on paper.

TITLE	**LESSON 4 – PROGRAMMING IF STATEMENTS**
OBJECTIVES	To write a sequence to produce a recognisable event, in this case using "if statements" in order to get an on screen robot to follow a line. As a result the children should recognise the need for precision when writing a number of procedures in one sequence of instructions. They should also recognise that devices rely on a set of instructions that can be repeated, as in the loop required.
TIME	1 session
PRE-REQUISITES	Have completed lessons 1 to 3
RESOURCES	"Lesson 4 - Programming If statements" Director application copied to a shared directory which the children can access Ensure the directory I:\Robots\ exists
ACTIVITY	To correctly identify two more every day items as being a robot or not. To navigate a robot through a marsh, to "program" a robot to follow a line on screen.

Lesson breakdown

TIME	TASK	CONTENT
5 min	Introduction and log on	Ask them to decide with their partner if a tape recorder is a robot. They should say no – you can touch it, it has sensors (on and off buttons), an output, the motor turns the tape round, a behaviour, it records but you can't program in it. Explain that this week they will be doing more programming. Last week they learnt about what type of programming command? They should say loops. This week they are doing "if statements". The instructions are all on the screen so they need to carefully read them, it is not a race and their moves will be logged so the computer will know how good they are at programming. Then ask them to log on and open Lesson 4. Remind the children not to repeatedly double click as their machines will be unable to open the program.
35 min	Programming exercise	Children work together to complete the lesson. The children are given two objects to identify. Then two programming tasks. The first is to click on instructions to make the robot follow a line. If they end up in a marsh or out of bounds they will be asked to do it again. The aim is to get them use to the idea of turning based on the direction of the line. The second task requires the children to follow a path keeping the blue bricks to the left, and the yellow to the right. The program will provide error messages if the children incorrectly order the loop instructions, and allow them to redo the program until correct.
2 min	Log off	
45 min		

ANSWERS FOR LESSON 4

IS IT A ROBOT?

OBJECT	BODY	INPUT	PROGRAM	OUTPUT	BEHAVIOUR	IS IT A ROBOT
Alarm clock	yes	yes	no	yes	yes	no
Games console	yes	yes	yes	yes	yes	yes

EXERCISE 1

The process will take around 80 moves if done correctly.

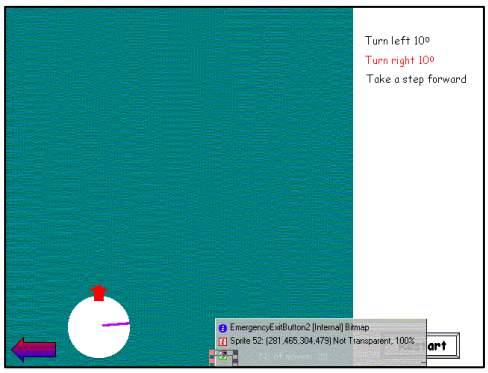
EXERCISE 2

This is one possible solution; changing the order of the steps, or even going forward twice before turning are equally valid solutions.

Repeat
Take a step forward
If the robot only sees blue
Turn right 10°
End if
If the robot only sees yellow
Turn left 10°
End if
Until you are at a wall

NOTES

- It is compulsory to enter two different names
- Only the first attempts at programming or moving the robot are recorded
- The scores are saved in the text file I:\Robots\Lesson4 Results.txt
- There is an emergency exit button which exits the program and stores all the answers so far, it can be found on the bottom of the screen near the middle, i.e.:



Title	**LESSON 5 – INPUT AND OUTPUTS**
Objectives	To recognise that control technology is all around them and that things do not happen without cause and effect. This is done by looking at the various types of sensors which exist, both in humans and robots. To understand these sensors provide different inputs, depending on the situation or type of robot, and cause different outputs. To identify the relationship between inputs and outputs through practical examples. The discussion that arises should cause the children to focus on who or what makes things work 'automatically'. It should also highlight that humans and robots can have multiple inputs and outputs.
Time	1 session
Pre-requisites	Completed lessons 1 to 4
Resources	"Lesson 5 – Input and Outputs" Director application copied to a shared directory which the children can access Copies of the Lesson 5 Worksheet Ensure the directory I:\Robots\ exists
Activity	To identify human and robot inputs and the corresponding outcomes or outputs.
Extension activity	Lesson 5 Worksheet (Word document on disk) – which is a table to be completed asking for inputs and outputs of various devices and blank rows in which to put their own objects

Lesson breakdown

TIME	TASK	CONTENT
5 min	Introduction and log on	Give all the children the blank assessment form. Tell them to write down three rules for working well together that they have agreed with their partner. At 5-minute intervals I am going to ask them to write down how well they thought they worked together, 1 being not at all, and 5 perfectly. It is very important they do not show each other their answers, or talk to each other about their answers until I ask them to. Then they are going to spend a minute saying why they differed if they did, what they could do to improve, or to give an example. Ask them for the five things a robot needs, then to decide in their pairs if they are robots. They should say no, as they cannot be programmed. Ask them what type of inputs they have. Explain today's lesson is about inputs and outputs. They are going to do a quiz but they have to think carefully as the computer is going to record all their answers and display them at the end. It's very important they work together and agree before choosing an answer. Remind them to read the instructions carefully and not to repeatedly double click as their machines will be unable to open the program. Then ask them to log on and open Lesson 5.

33 min	Input and Output	Answer the computer questions and if finished do the worksheet as well as reflect on behaviour when asked using the scale described.
3 min	Reflect on performance	Children are asked to assess how well they worked together overall using a scale of 0, not at all, to 00 worked perfectly.
2 min	Log off	
45 min		

ANSWERS TO LESSON 5

Question 1

The children have to drag the definition to the appropriate box. If after five attempts they have not finished the correct answer remains in the box so they just change incorrect answers.

NAME	DEFINITION
Body	A physical form of some type - so it can be touched.
Input	Information loaded into a system from it's sensors, so it knows what is going on around it or that it has to do something.
Program	The instructions or set of rules you give it to follow.
Output	The action it takes, usually involving motors (movement), lights, or sound, as a result of the instructions.
Behaviour	What it does.

Question 2

The children are asked to type in the five human sensors into the five boxes, if they get it wrong after five attempts they are given pictures of the five sensors. The answers are:

Skin - the picture is of a hand but you feel through the skin

Ears

Nose

Mouth

Eyes

They can be entered in any order.

Question 3

The children have to click on the appropriate sense and output/behaviour. It will turn white when selected. The children have to click on the arrow to go to the next sub-question. The questions can be given in any order. If they get the answer wrong, it tells them whether the input or output or both are incorrect.

SENSES	PROVIDES THIS INPUT	OUTPUT/BEHAVIOUR
Touch	You are hot from running around	Sweat to cool off
Touch	You put hand in boiling water	Yell and pull away
Taste	You are eating brussel sprouts	Eat or spit out
Hear	Somebody whispers	Move towards or away
Smell	Somebody lets off a stink bomb	Move towards or away
See	There is £10 on the floor	Move towards or away
Taste	You are eating chocolate	Eat or spit out
Hear	You are by a speaker in an Eminem concert	Move towards or away
See	Torch in eyes	Squint

Question 4

The children must match the pictures of sensors to the sensor types by dragging the sensor name to the box. The sensors in order are:

Touch

Light

Temperature

Touch

This answer is not included in lesson scores at end.

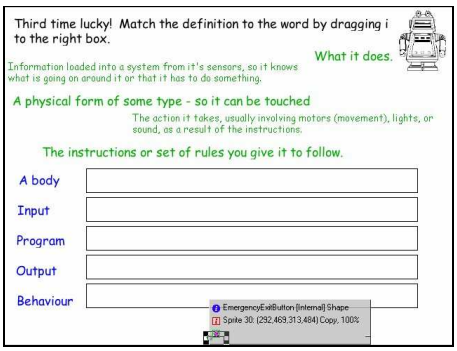
Question 5

The children have to click on the appropriate input sensor and output. It will turn white when selected. The children have to click on the arrow to go to the next sub-question. The questions can be given in any order. If they get the answer wrong, it tells them whether the input or output or both are incorrect.

INPUT SENSORS	ROBOT	OUTPUT
Light	Street lights that come on when dark	Lights turn on
Temperature	Heat detecting smoke alarm	Alarm sounds
Motion	Automatic lights that come on when approached	Lights turn on
Infrared	TV controlled by a remote control	Program or message plays
Temperature	Vent in greenhouse which opens when it's too hot	Doors open
Humidity	Watering system that comes on when the air is too dry	Water on
Touch	Answer phone	Program or message plays
Touch	Cash point	Display price or balance
Motion	Sliding doors	Doors open
Infrared	Shop till with a scanner	Display price or balance

NOTES

- It is compulsory for the children to enter two different names
- The scores are saved in the text file I:\Robots\Lesson5 Results.txt
- There is an "Emergency Exit button" at the bottom of every screen slightly left of centre, i.e.:



APPENDIX K: LOG FILE SUMMARY

These tables summarise the self-monitoring of children from Group D, who used the DSGS v2 model implemented as the Aliens software. They were gathered as part of Study 5. The children come from School X, a Church of England Junior School. Their marks are similar to the National Average in mathematics, science, and English (see Appendix F).

Cases where the time taken is greater than five minutes are removed from the averages as it is assumed the children have returned to the teacher-given task (TGT) instead of completing the group skills task (GST).

		STAGE 1						
			NUMBER OF TIMES THE RULE WAS CHOSEN THAT WEEK					
DATE	TOTAL PARTIC-IPANTS	AVERAGE TIME TO CHOOSE RULES (< 5 MIN)	DO NOT CHEAT	MAKE SURE YOU BOTH UNDERSTAND	TAKE TURNS	AGREE BEFORE YOU PERFORM AN ACTION	LISTEN TO EACH OTHER	OWN RULES
16 Jan	20	00:00:17	5	3	6	7	7	2
27 Jan	22	00:00:08	1	2	10	10	9	1
30 Jan	22	00:00:10	2	6	9	5	10	1
6 Feb	20	00:00:09	4	3	9	5	8	1
16 Feb	22	00:00:10	7	5	7	6	8	0
27 Feb	28	00:00:07	9	5	9	9	9	1
6 Mar	24	00:00:06	3	5	10	8	8	2
13 Mar	26	00:00:04	4	6	9	7	11	2
20 Mar	26	00:00:09	4	8	11	6	9	1
27 Mar	30	00:00:07	4	8	12	9	10	2
3 Apr	28	00:00:05	1	10	8	8	13	2
24 Apr	28	00:00:06	7	5	6	11	11	2
8 May	24	00:00:04	3	8	6	9	10	0
15 May	28	00:00:06	2	9	10	10	10	1
5 Jun	26	00:00:08	4	7	7	8	12	1
12 Jun	30	00:00:15	8	11	7	6	7	6
19 Jun	30	00:00:07	7	8	6	12	10	2
25 Jun	28	00:00:06	5	6	7	11	11	2
Average	***25.67***	***00:00:08***	***4.44***	***6.39***	***8.28***	***8.17***	***9.61***	***1.61***

KEY

Total participants – Number of log files collected
Average time to choose rules – Time taken to choose the three rules

The remaining columns show the number of times the rules from the database were selected

DATE	STAGE 2			
	AVERAGE TIME FOR SELF REFLECTION (<5MIN)	AVERAGE PUPILS OPINION DURING TGT	AVERAGE DIFF IN OPINION	AVERAGE DISCUSSION OF SCORES TIME (<5 MIN)
16 Jan	00:00:19	3.00	0.46	00:00:25
27 Jan	00:00:17	4.00	0.71	00:00:15
30 Jan	00:00:18	3.00	0.62	00:00:16
6 Feb	00:00:11	4.25	0.32	00:00:13
16 Feb	00:00:09	4.00	0.56	00:00:09
27 Feb	00:00:07	4.50	0.41	00:00:07
6 Mar	00:00:10	4.00	0.41	00:00:06
13 Mar	00:00:13	4.25	0.65	00:00:06
20 Mar	00:00:08	4.00	0.51	00:00:10
27 Mar	00:00:06	4.00	0.40	00:00:07
3 Apr	00:00:08	4.00	0.51	00:00:12
24 Apr	00:00:07	4.00	0.41	00:00:12
8 May	00:00:10	4.25	0.45	00:00:21
15 May	00:00:07	4.00	0.45	00:00:18
5 Jun	00:00:11	4.25	0.26	00:00:28
12 Jun	00:00:07	4.00	0.45	00:00:11
19 Jun	00:00:05	4.00	0.60	00:00:18
25 Jun	00:00:08	4.25	0.53	00:00:14
Average	***00:00:10***	***3.99***	***0.48***	***00:00:14***

KEY

Average time for self reflection – average time taken for self-assessment in Stage 2, during the TGT

Average pupils opinion during TGT – average self-assessment value (range 1 to 5)

Average diff in opinion – average difference in self-assessment values between the pair

Average discussion of scores time – average time between both children entering self-assessment values and returning to the TGT (this does not necessarily reflect the time spent discussing the GST)

Date	Stage 3					Stage 4
	Average pupil's overall opinion of TGT	Average difference between overall scores	Time to decide opinion	Number of identical scores	Number of scores within 10	Average numeric score from computer
16 Jan	54.00	34.20	00:01:13	2	4	59.41
27 Jan	49.09	16.18	00:00:42	6	6	51.81
30 Jan	53.91	13.64	00:00:35	6	8	46.96
6 Feb	66.60	5.20	00:00:36	10	4	62.49
16 Feb	70.55	5.64	00:00:27	16	2	62.11
27 Feb	72.75	12.64	00:00:26	12	8	67.43
6 Mar	69.17	16.17	00:00:28	2	8	62.72
13 Mar	70.27	7.77	00:00:29	8	6	60.82
20 Mar	65.77	25.31	00:00:29	6	2	59.48
27 Mar	65.43	7.13	00:00:38	12	10	63.22
3 Apr	68.79	14.14	00:00:29	4	12	63.62
24 Apr	75.00	9.00	00:00:31	6	16	67.51
8 May	72.79	10.92	00:00:36	4	14	67.21
15 May	66.86	7.00	00:00:32	12	8	63.01
5 Jun	71.50	4.85	00:00:43	6	16	70.56
12 Jun	64.13	7.87	00:00:26	6	16	63.38
19 Jun	65.63	3.67	00:00:18	16	8	62.79
25 Jun	67.07	11.43	00:00:25	11	10	63.16
Average	***66.07***	***11.82***	***00:00:34***	***8.06***	***8.78***	***62.09***

Key

Average pupil's overall opinion of TGT – average overall assessment for group skill usage
Average difference between their scores – average difference in overall self-assessment values between the pair
Time to decide opinion – average time for both children to entering overall self-assessment values
Number of identical scores – number of occasions when both children gave the same overall assessment
Number of scores within 10 – number of occasions when both children gave an overall assessment within 10% of their partner
Computer score – numeric score returned by the Aliens software (rounded to a whole number when given to the children)

APPENDIX L: THE PUZZLES

In this section the four puzzles used in Phases 1 and 3 of Study 6 are described. They were designed with the aid of eight children who were aged 9 and 10. They consisted of two girl-girl pairs, one boy-boy pair and one mixed pair. This type of informant design was to ensure the level of difficulty was appropriate, the wording could be understood, and it was possible to record the number of moves. Each puzzle was designed to take around half an hour.

The puzzles for six are far transfer tasks. They require the manipulation of physical props and the group is larger than the pairs exposed to the DSGS v2 model. The puzzles for pairs are near transfer tasks, since the group is the same size and the activity is computer based.

In the puzzles for a group of six, the sessions were videoed in order to calculate the number of moves, and amount of help and restarts. In the puzzles for pairs a log file was generated that recorded the number of moves, times, and if they existed the clues opened. The researcher kept a note of the number of times the children asked for additional assistance. The four parts are:

- L1 - the Statue puzzle, which contains a list of props and the written instructions
- L2 - the Frogs puzzle, which contains a list of props, the written instructions and solution
- L3 - the Return to Earth puzzle, which contains the rules, examples of screen shots and the log file generated
- L4 - the Petshop puzzle, which contains the rules, examples of screen shots and the log file generated

L1. The Statue

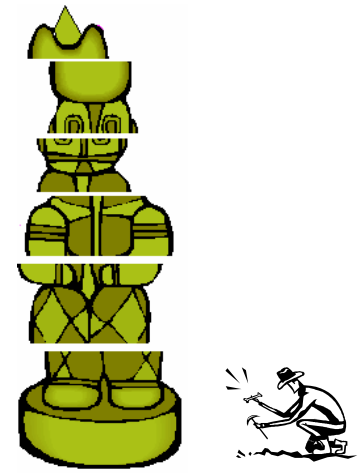
This is a puzzle for six children based on the Tower of Hanoi problem.

The group of six were given a wallet containing:

- The instruction sheet – this is shown on the next page
- Six A4 printed sheets - each one had a piece of the statue shown and the corresponding number (1 = head etc.) printed on it. They were identical to the pictures on the instructions
- Four sheets with the base lines and a letter A, B, C or D on it, these were also identical to the pictures on the instructions

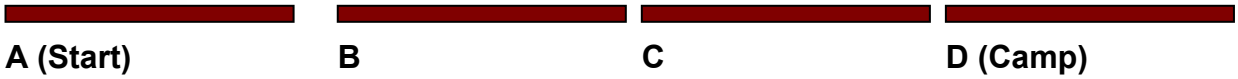
THE STATUE

You are archaeologists working in darkest Peru and have discovered an ancient statue. While it was buried it broke into 6 pieces. You carefully dig round it and label the pieces in order, the hat is number 1, down to the feet being number 6. You have to move the statue to your camp before it gets dark. However, there are lots of holes around the site, which means there are only 3 places, and the hole, strong enough to rest the pieces on. These places are just the size of the base. Each piece is very fragile, and you can only move one at a time. All the others must be on a place that can support it. You have a problem though. Each piece is heavier than the one above it, and if you put a heavier piece on top of another then it will break. So if you had the shoulders, block 3, on place D, you cannot put the feet, block 6, on top of it as you would break that part of the statue. If the feet were on place D though, then you could rest the shoulders on top and nothing would break.



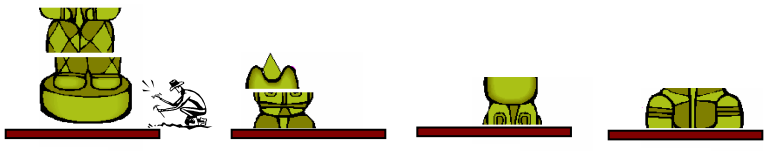
Can you work out how to move the statue to the camp?

You will be given 25 minutes to find an answer. You can use the pieces or each pretend to be a piece of statue and move in the right order.



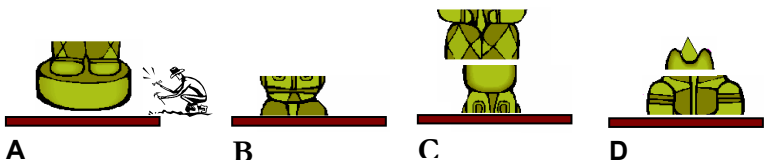
A (Start) **B** **C** **D (Camp)**

The picture below shows the statue being moved correctly.



A **B** **C** **D**

This picture shows a mistake, you cannot put the statues knees on the face, as it will break the face.



A **B** **C** **D**

L2. The Frogs puzzle

This is a puzzle for six children. It is of similar complexity to the Tower of Hanoi problem.

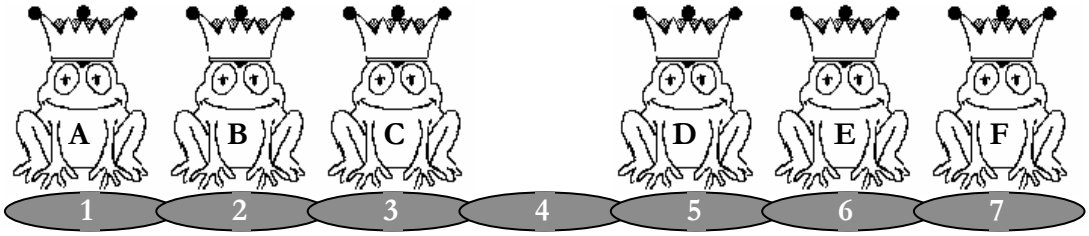
The group of six were given a wallet containing:

- The instruction sheet – this is shown on the next page
- Six A5 cards - each one had a different coloured frog printed on it of the same style as the instruction sheet, with a letter between A and F on its stomach
- Seven A4 coloured cards to represent the lily pads – each one had a number between 1 and 7 printed on it

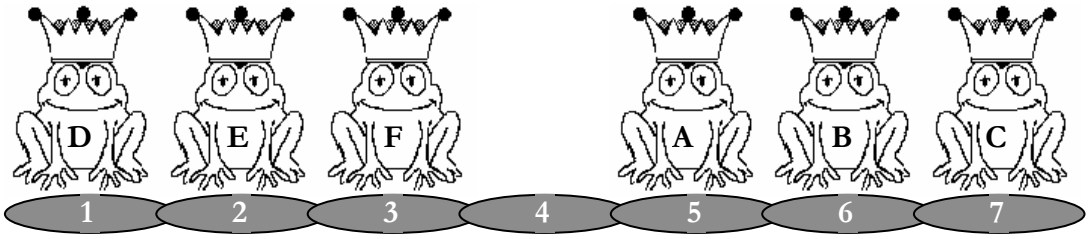
One version of the Frogs puzzle solution is also given in this appendix, but it was not given to the children.

FROGS

In the morning the royal frogs A, B, and C are on pads 1, 2 and 3, and the royal frogs D, E and F on pads 5, 6 and 7.



But they are fussy lazy frogs and decide that they do not like where they are sitting. Frogs A, B and C want to sit on pads 5, 6 and 7; and frogs D, E and F want to sit on pads 1, 2 and 3, as shown in the picture below - but they want to move with the smallest number of hops and shuffles.



Can you help them? Each person in the group take the place of one frog and work out the shortest number of moves together.

The only rules are:

Frogs can only jump over **one** other frog onto an empty pad.

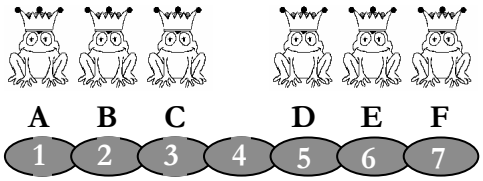
Frogs A, B and C can only move RIGHT one pad at a time.

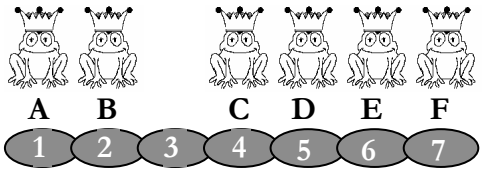
Frogs D, E, and F can only move LEFT one pad at a time.

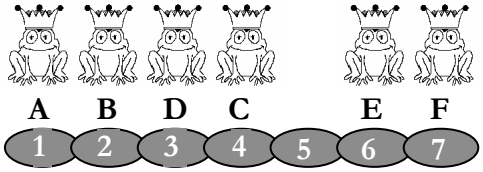
You will be asked for an answer after 25 minutes.

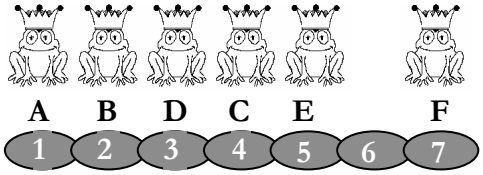
Frogs - Solution

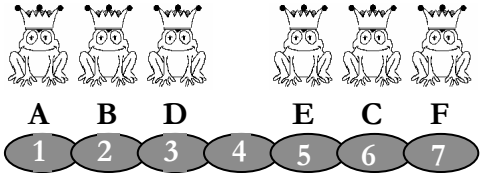
Start

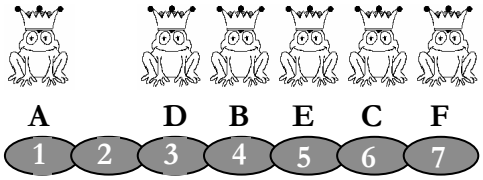


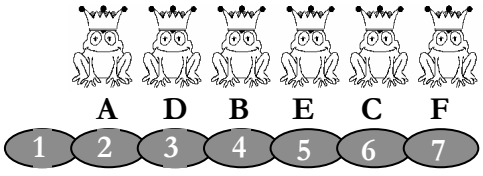


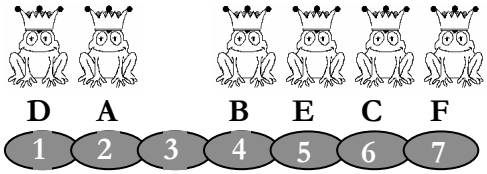


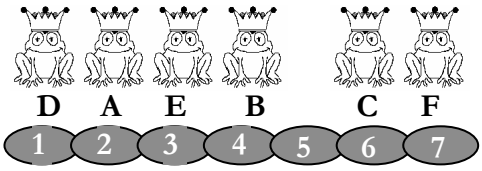


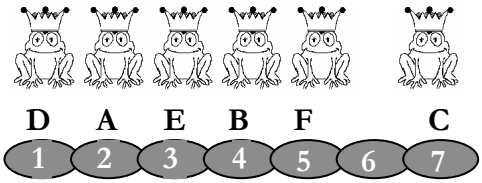


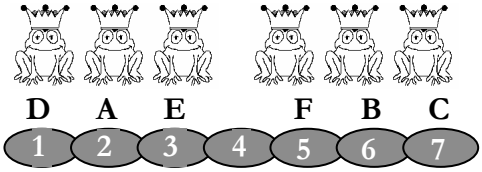


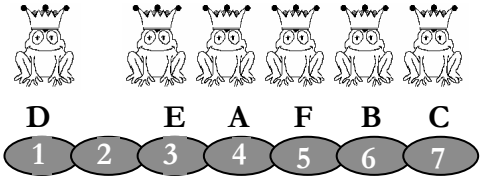


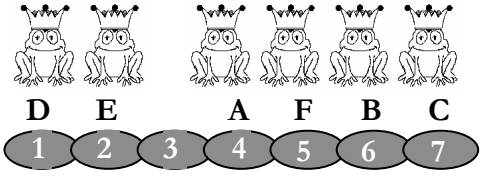


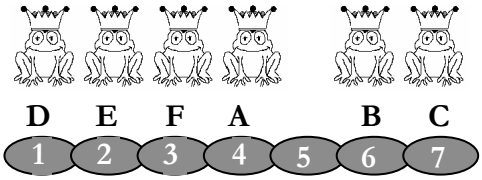


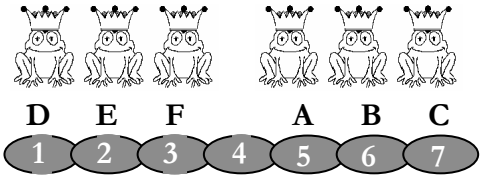












22.1

This is only one solution; the children could begin by moving D and perform a similar process.

L3. Return to Earth

This puzzle is isomorphic to the Missionaries and Cannibals task. It is written in Macromedia Director. It was designed to be solved by pairs of children.

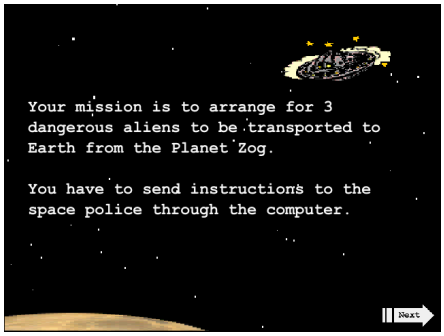
The children are asked to send instructions to some policemen on the planet Zog so they can transport themselves, and three alien criminals up to their space ship. The procedure for moving the characters is shown in an animated sequence. The task has three rules.

1) There must never be more aliens than policemen on Zog or the spaceship as they will manage to escape
2) The shuttle can only hold two people
3) At least one alien or policeman must be in the shuttle to drive it

If rule 1) is broken a warning message appears and the puzzle is restarted. If rule 2) is broken a warning message is displayed and the third character returns to their starting place. If rule 3) is broken a warning message is displayed and the children return to the same point and must put a character in the shuttle. The character goes partially transparent and the status of the shuttle occupants is displayed in the top left hand corner so the children can check the occupancy before blasting off. If they succeed, they are given the option to repeat the task. Screen shots corresponding to these stages can be found in Figure L1.

1. Introductory screen

2. Record the children's names

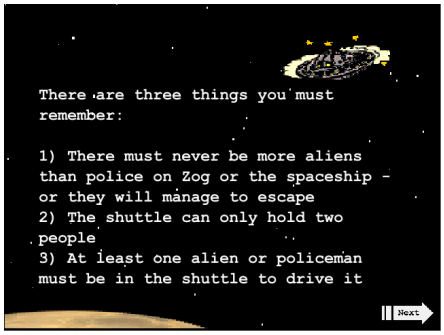


3. Instructions – screen 1

4. Instructions – screen 2 (animated sequence)

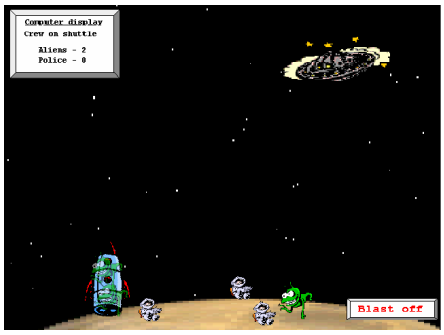
5. Instructions – screen 3 (animated sequence)

6. Instructions – screen 4 (animated sequence)



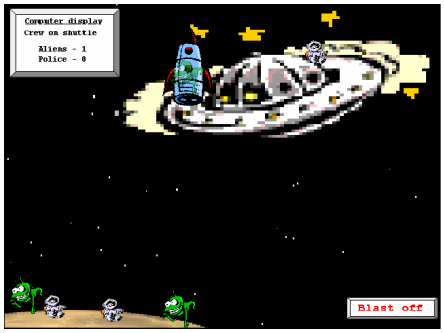
6. Instructions – screen 5 (rules)

7. Personalised good luck message

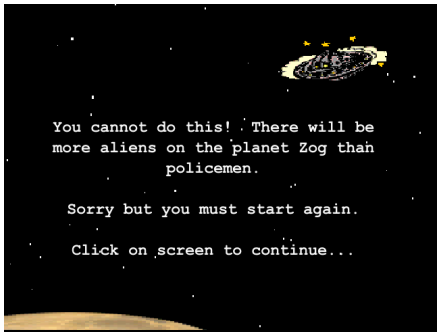


8. Game in progress

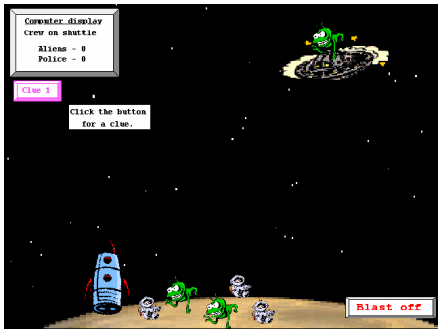
9. Rule 2) error message, this would appear if the children had tried to put another character in the shuttle instead of clicking Blast off in screen 8



10. Game in progress, children have just broken Rule 1)

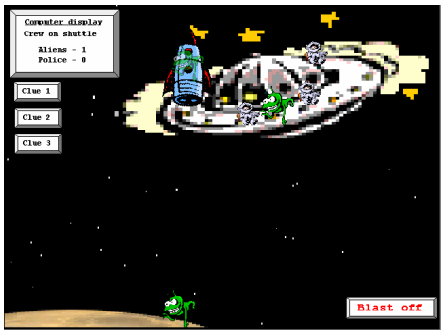


11. Rule 1) error message that appears as a result of screen 10. A similar message is given if a move will result in more aliens on the spaceship than policemen

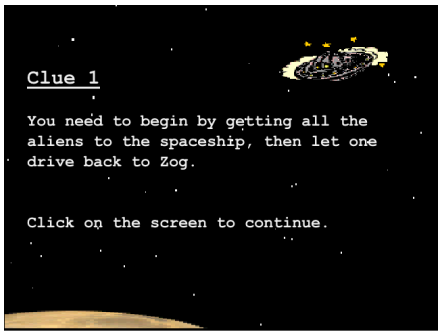


11. Clue 1 button - this appears after 6 shuttle trips and remains on screen. A record is made of whenever a clue is viewed, but there are no limits to how often this is done

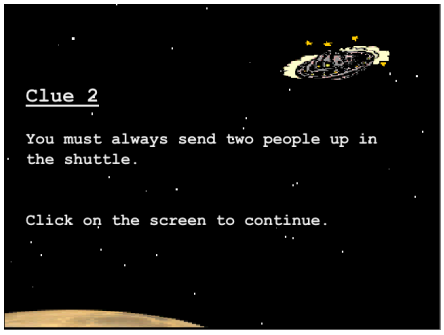
12. Rule 3) error message, would appear if the children had tried to click Blast off in screen 11



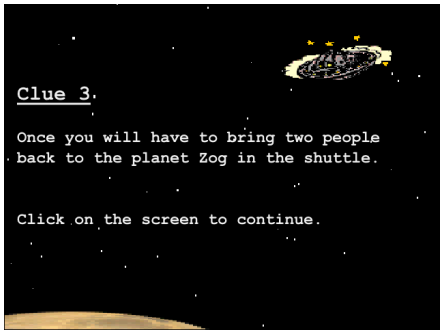
13. Clue 2 button appears after 12 shuttle trips, Clue 3 button appears after 18 shuttle trips



14. Clue 1



15. Clue 2



16. Clue 3

17. Message screen on successful completion

Figure L1: Screen shots from Return to Earth

The software generates a log file which records: the children's names, moves and time executed, clues accessed and when. The start of a new game shows the children committed an error causing the aliens to outnumber the space police on Zog or the spaceship. These are analysed as part of Study 6b. An example of a log file is given in Box L1.

```
Alice Jessie Time:  11:18:21
****STARTING NEW GAME*****  Time:  11:18:57
AliensOnZog: 2 PoliceOnZog: 2 AliensOnSpaceShip:  1 PoliceOnSpaceShip: 1 11:19:42
AliensOnZog: 2 PoliceOnZog: 3 AliensOnSpaceShip:  1 PoliceOnSpaceShip: 0 11:19:57
****STARTING NEW GAME*****  Time:  11:20:17
AliensOnZog: 2 PoliceOnZog: 2 AliensOnSpaceShip:  1 PoliceOnSpaceShip: 1 11:20:28
AliensOnZog: 2 PoliceOnZog: 3 AliensOnSpaceShip:  1 PoliceOnSpaceShip: 0 11:20:36
Looked at Clue 1 - 11:21:01
****STARTING NEW GAME*****  Time:  11:21:33
AliensOnZog: 2 PoliceOnZog: 3 AliensOnSpaceShip:  1 PoliceOnSpaceShip: 0 11:21:57
AliensOnZog: 2 PoliceOnZog: 3 AliensOnSpaceShip:  1 PoliceOnSpaceShip: 0 11:22:07
AliensOnZog: 2 PoliceOnZog: 3 AliensOnSpaceShip:  1 PoliceOnSpaceShip: 0 11:22:23
AliensOnZog: 3 PoliceOnZog: 3 AliensOnSpaceShip:  0 PoliceOnSpaceShip: 0 11:22:33
****STARTING NEW GAME*****  Time:  11:22:49
AliensOnZog: 1 PoliceOnZog: 3 AliensOnSpaceShip:  2 PoliceOnSpaceShip: 0 11:22:58
AliensOnZog: 2 PoliceOnZog: 3 AliensOnSpaceShip:  1 PoliceOnSpaceShip: 0 11:23:07
```

Box L1: Extract from log file from Return to Earth

L4. The Petshop Puzzle

This puzzle is isomorphic to the Tower of Hanoi task. It is written in Macromedia Director. It was designed to be solved in pairs.

The children are instructed to move four fish from a small tank to a large one. They are given two rules:

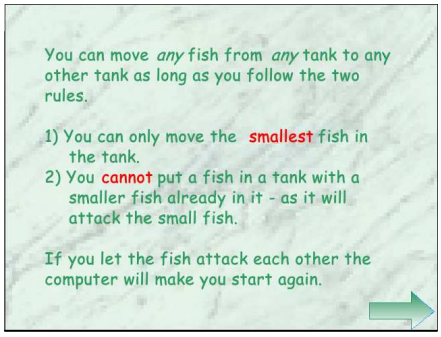
1) You cannot put a fish in a tank with a smaller fish already in it - as it will attack the small fish.
2) You can only move the smallest fish in the tank.

If rule 1) is broken there is an explanation and the puzzle is restarted. If rule 2) is broken a warning message appears and the fish is not moved. The number of moves taken so far is displayed on the screen.

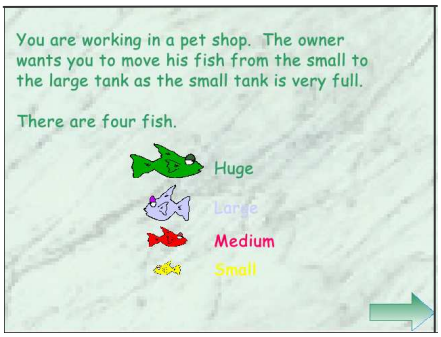
If they succeed, they are given the option to repeat the task, or they can try with only three bowls. The first exercise is equivalent to four rods and four rings in the Tower of Hanoi task; the continuation exercise is equivalent to three rods and four rings. Screen shots corresponding to these stages can be found in Figure L2.

1. Introductory screen

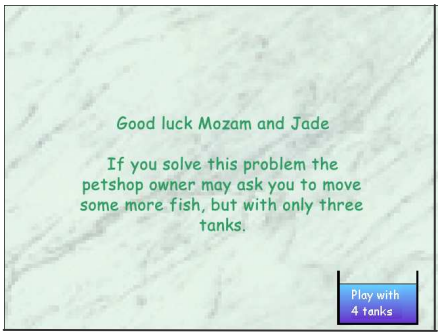
2. Record the children's names



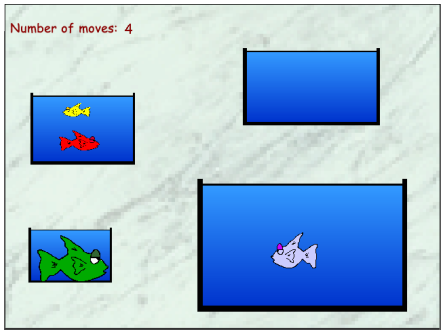
3. Instructions – screen 1



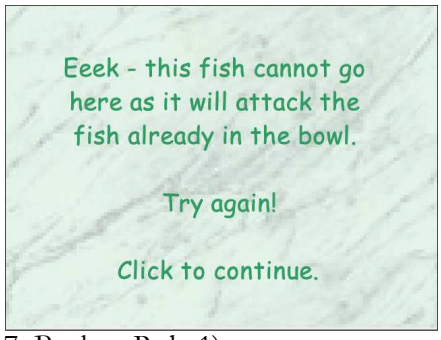
4. Instructions – screen 2



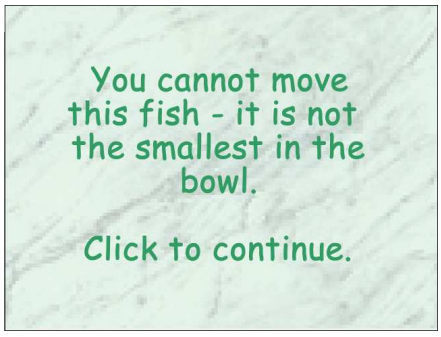
5. Personalised good luck message



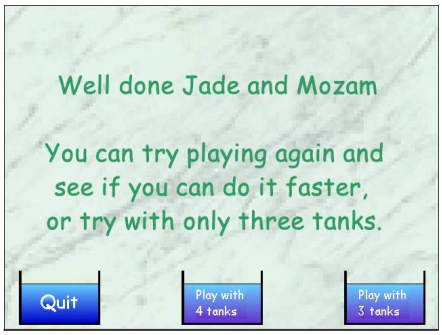
6. Game with 4 tanks in progress



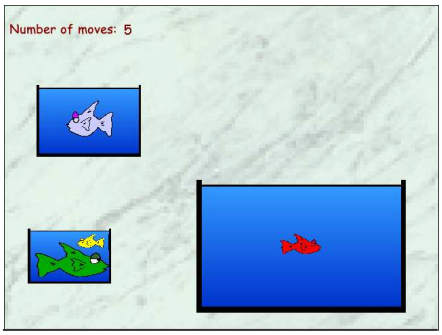
7. Broken Rule 1) error message – causes children to restart game



8. Broken Rule 2) error message – a go is recorded but no fish is moved



9. Message screen on successful completion



10. 3 tank game in progress (the same rules apply)

Figure L2: Screen shots from The Petshop Puzzle

The software generates a log file which records: the children's names, moves and time executed, and the type of error made and when. These are analysed as part of Study 6b. An example of a log file is given in Box L2.

```
Mozam Jade Time:  9:47:12 AM
***STARTING WITH 4 TANKS*** 9:47:51 AM
Gold moved to  2 9:48:02 AM
Green moved to  4 9:48:09 AM
Error - not selected the smallest fish
Red moved to  3 9:48:20 AM
Red moved to  1 9:48:32 AM
Lilac moved to  1 9:48:36 AM
Red moved to  3 9:48:38 AM
Lilac moved to  4 9:48:45 AM
Green moved to  4 9:48:47 AM
Error - larger fish in bowl
***STARTING WITH 4 TANKS*** 9:48:48 AM
Gold moved to  2 9:48:54 AM
Lilac moved to  3 9:49:04 AM
Error - not selected the smallest fish
Red moved to  3 9:49:10 AM
Lilac moved to  3 9:49:12 AM
Error - larger fish in bowl
```

Box L2: Extract of log from Petshop Puzzle

APPENDIX M: LESSON PLAN OVERVIEW

The following is an overview of the Information and Communication Technology lessons held in the schools participating during Study 6. They differ based on the previous experience of the children and existing lesson plans. Both the control classes and those using the Aliens software followed the same ICT course. Each lesson is approximately 45 minutes.

These lesson plans are based on the Department for Education and Skills scheme of work for Year 5 (DfES 2001). These can be found online at http://www.standards.dfee.gov.uk/schemes/it/. The Control lessons, Unit 5E, incorporate lesson plans based on the Lego Dacta™ Teacher Notes. Each was detailed and given to the teachers for approval before the lesson. Examples of the format of the lesson plans can be found in Appendix J.

WEEK BEGINNING	SCHOOL Y	SCHOOL X
Jan 15th	Plants database worksheet	Plants database worksheet
Jan 22nd	Create own database on animals	Create own database on cereals
Jan 29th	Complete database	Complete database
Feb 5th	Complete database	Complete database
Feb 12th	Create and check for anomalies in database	Create and check for anomalies in database
Feb 19th	Half term	
Feb 26th	ICT suite unavailable	Graphical modelling: Introduction
Mar 5th	ICT suite unavailable	Graphical modelling: Matisse style pictures
Mar 12th	ICT suite unavailable	Graphical modelling: Scale drawing (1)
Mar 19th	ICT suite unavailable	Graphical modelling: Scale drawing (2)
Mar 26th	Monitoring the environment (The Weather Quiz)	Spreadsheets: Fantasy Football worksheet
Apr 2nd	Graphical modelling: Matisse style pictures	Spreadsheets: Fantasy Football worksheet (cont.)
Apr 9th	Easter holiday	
Apr 16th		
Apr 23rd	Control: Recognising a robot	Spreadsheets: Hamburger Joint (worksheet in spreadsheet)
Apr 30th	Control: Building robotic arms with Lego	Children on a week long school trip
May 7th	Control: Loops	Environmental modelling: Testing theories using spreadsheet on

WEEK BEGINNING	SCHOOL Y	SCHOOL X
		weather
May 14th	Control: If …then …else statements	Environmental modelling: Testing theories using spreadsheet on weather (cont.)
May 21st	Control: Input and Output	OFSTED inspection
May 28th	Half term	
Jun 4th	Control: Flow diagrams	Environmental modelling: Creating spreadsheet with own weather observations and testing theories
Jun 11th	Control: Revision exercises	Control: Recognising a robot
Jun 18th		Control: Advantages and disadvantages of robots
Jun 25th		Control: Repeat loops
Jul 2nd		Control: If …then …else statements
July 9th		Control: Input and Output

APPENDIX N: SCHOOL X ICT QUIZ

This was used to test the information recalled throughout the Information and Communication Technology (ICT) lessons in Phase 3b of Study 6. It was given at the end of the summer term. The teachers were instructed not to assist and the children were asked to work individually. The children had up to 45 minutes to complete the task. The question areas were:

- Definitions for the five attributes needed to be a robot
- Identifying whether a car was a robot
- Programming a robot to navigate a course
- Spreadsheet
    - Identifying a cell
    - Using a spreadsheet to calculate a cost
    - Recognising a formula
- Database
    - Can a database have mistakes?
    - Interrogating a database by one attribute
    - Interrogating a database by two attributes
- Hypotheses testing
    - What is a hypothesis?
    - How is it tested using a spreadsheet?
- Human senses input and output
    - Somebody pinches you very hard
    - You are eating fish and chips
    - The fire alarm goes off
- Robot input and outputs
    - Button for opening door
    - Fire alarm that rings when it is too hot
    - Lights that come on when it gets dark

The questions were given in a random order, except for the identification of a robot, which occurred after the five necessary attributes definition. As shown in the question listings the children were given clues if they made an error. Initially these were prompts to try again, and

gradually became more structured with further errors. If the child failed after a predefined number of attempts, the next question was given.

The quiz was written in Macromedia Director 7. It recorded a log file containing the questions, answers, and times which was used in the analysis of Study 6a.

The children had previously used the animal Junior Pinpoint database and the Excel spreadsheet about football (see Appendix M); both of these were already open on the machine for the children.

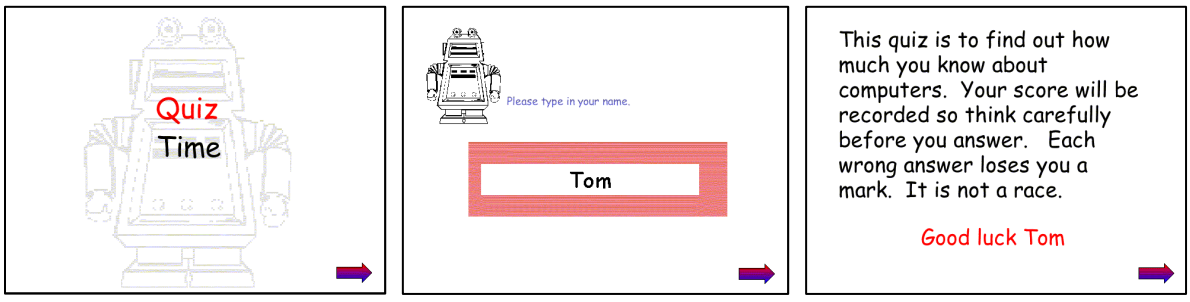
QUIZ SCREENS

The quiz was designed with the assistance of two children. They were selected as representing a range of abilities. The same questions were given with the researcher providing prompts as necessary. The children assessed the helpfulness and order of these so they could be included in the software.

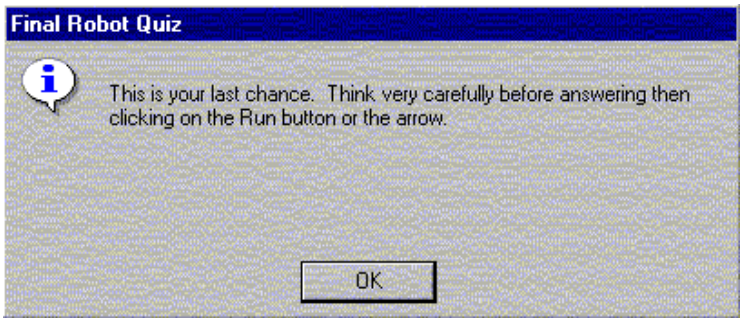
The remainder of this section is the overview of the Quiz.

Standard screens

Each child is given the same three initial animated screens as shown below. In all the system prompts <Name> is replaced by the entered child's name from the middle screen below.

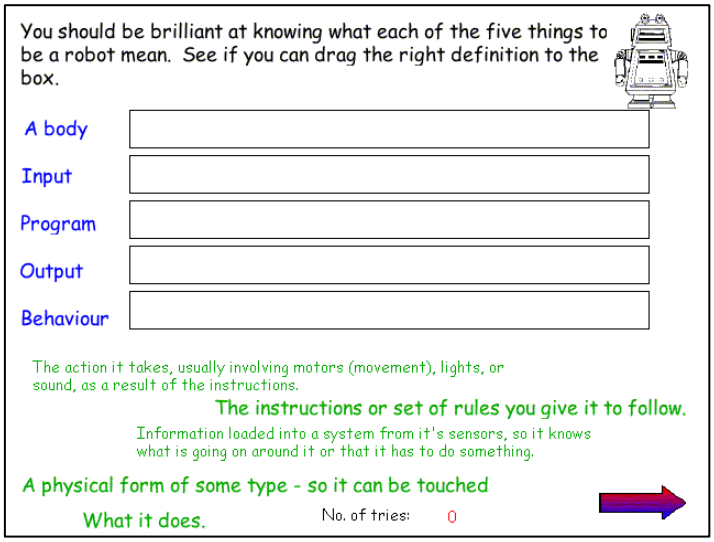


The standard warning message shown in the next screen shot was given before the children's last attempt at a question. If they failed, the application randomly selected the next question.



The remainder are the question screens. As stated they can be given in any order.

Five things a robot needs

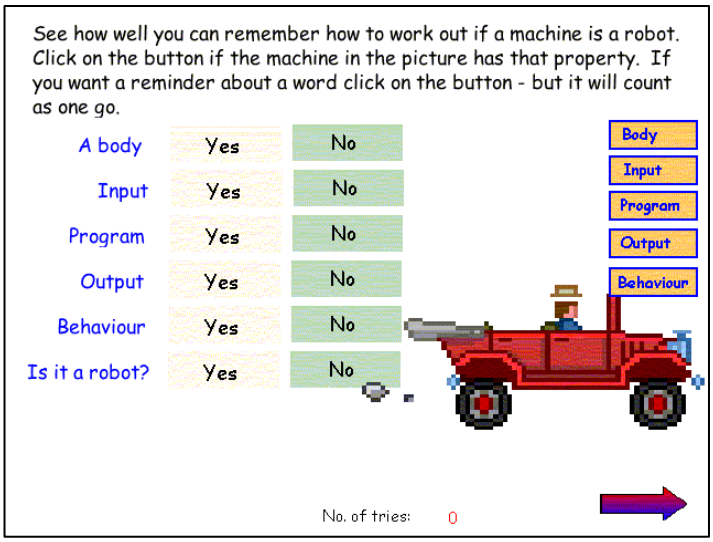


Answer

A body – A physical form of some type so it can be touched.
Input – Information loaded into a system from it's sensors, so it knows what is going on around it or that it has to do something.
Program – The instructions or rules you give it to follow.
Output – The action it takes, usually involving motors (movement), lights or sound as a result of the instructions.
Behaviour – What it does.

ATTEMPT NUMBER	SYSTEM RESPONSES
1	"Have another go" (Happens even if don't make a move)
2-5	"Try again – you have <x> out of 5" where <x> is the number of correct answers All the definitions return to starting point
6	"Try again, if it's correct it will stay in the right box"
7 - 11	"Keep going <Name> - you can do it"
12	Preceded by warning message box

Is this a robot?



Answer

A body – yes

Input – yes

Program – no

Output – yes

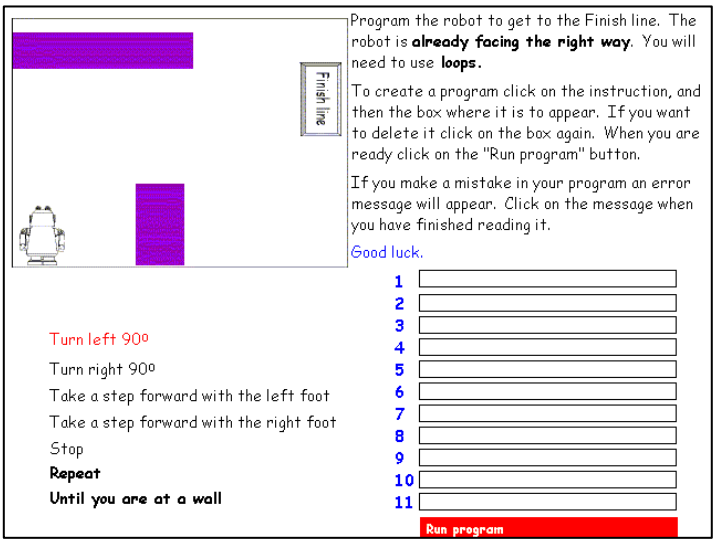
Behaviour – yes

Is it a robot? – no

Note the car is animated

ATTEMPT NUMBER	SYSTEM RESPONSES
No answer, incomplete or wrong	"Try again!"
	Viewing a reminder message (the buttons on the right of the screen) also counts as an attempt, as these can be viewed no hints were given
12	Preceded by warning message box

Programming the robot



The children are use to this sort of exercise having done a similar exercise as part of the Control: Repeat loops topic

Answer

1 Repeat
2. Take a step forward with the left foot
3. Take a step forward with the right foot
4. Until you are at the wall
5. Stop
6. Turn right 90°
7. Repeat
8. Take a step forward with the left foot
9. Take a step forward with the right foot
10. Until you are at the wall

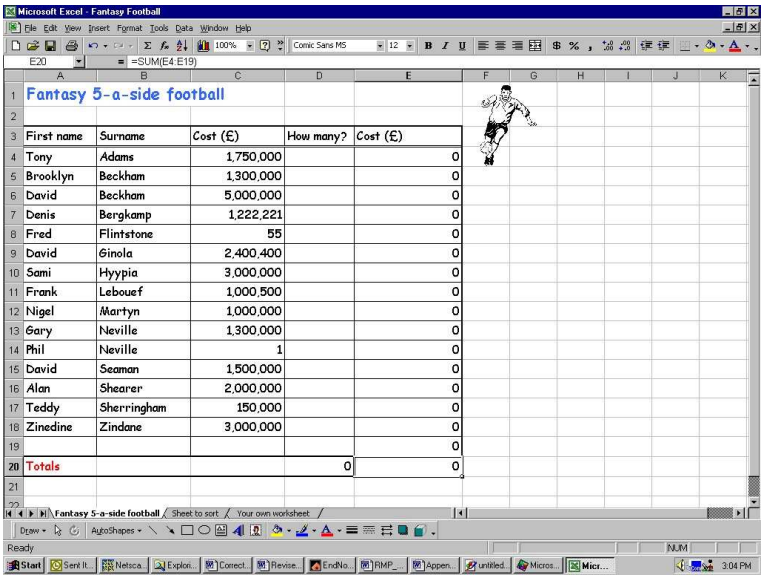
Note that the order of left foot and right foot is immaterial

ATTEMPT NUMBER	**SYSTEM RESPONSES**
No rules or incorrect 1-4	"Oh dear! The robot didn't make it to the Finish Line - click here to begin again."
Any time	*If the child has put a "Repeat" command after line 8* "You cannot have a Repeat instruction here"
Any time	*Incorrect loop contents* "Program compiler - Invalid loop command You can only put "Take a step forward with the left foot" and "Take a step forward with the right foot" between a "repeat" and "until you are at a wall" commands."
Any time	*More than 2 lines between loop command* "Program compiler - Invalid loop command You must put the "until you are at a wall" command two instructions after the "repeat" command."
Any time	*If the child does not close the Repeat loop, i.e., there is no "Until…" command three lines later* "You need to have the same number of 'Repeat' instructions as 'Until you are at the wall' instructions."
Any time	*The child has begun a Repeat loop but there are no subsequent instructions* "You need to make the robot take a step with each foot and then put 'Until you are at the wall' in Instruction 4"
Any time after 5 moves	*This message keeps on coming up until the child puts the "Repeat" command in the first line* "Instruction 1 should be 'Repeat'."
Any time after 5 moves	*The child has entered the first repeat loop and the subsequent command is incorrect.* "You need to stop in Instruction 5 before you can turn."
Any time after 5	*The child has no commands or is trying to walk without a turn command in the Instruction 6 row* "You need to turn in Instruction 6."
Any time after 5	*The child has added a turn but no further or incorrect instructions* "You need to begin another loop in Instruction 7"

Any time after 5	*The child has begun with a "Repeat" command in Instruction 7 but not completed the loop* "You need to make the robot take a step with each foot and then put 'Until you are at the wall' in Instruction 10."
12 - 14	*The child has not finished the puzzle so detailed instructions are given* "You should begin with a Repeat loop (Repeat, Take a step with the left foot, Take a step with the right foot, Until you are at the wall). Then Instruction 5 = Stop, Instruction 6 = Turn, and then do another repeat loop."
15	Preceded by warning message box

Spreadsheet questions

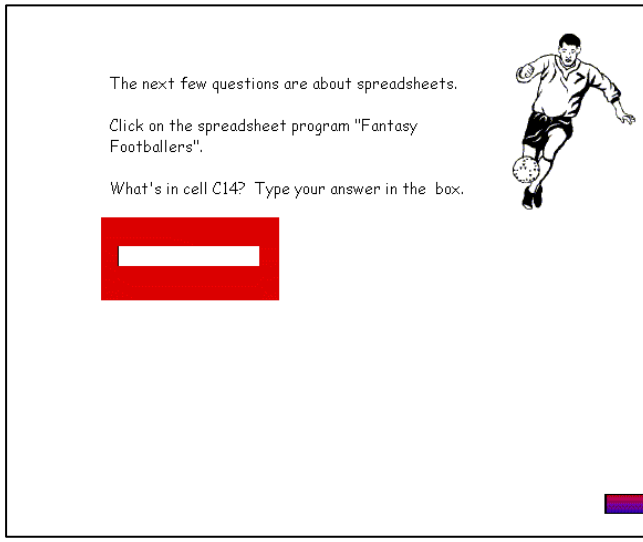
Requires the spreadsheet "Fantasy Football.xls" shown in the screen shot below:



Microsoft Excel - Fantasy Football

Fantasy 5-a-side football

First name	Surname	Cost (£)	How many?	Cost (£)
Tony	Adams	1,750,000		0
Brooklyn	Beckham	1,300,000		0
David	Beckham	5,000,000		0
Denis	Bergkamp	1,222,221		0
Fred	Flintstone	55		0
David	Ginola	2,400,400		0
Sami	Hyypia	3,000,000		0
Frank	Leboeuf	1,000,500		0
Nigel	Martyn	1,000,000		0
Gary	Neville	1,300,000		0
Phil	Neville	1		0
David	Seaman	1,500,000		0
Alan	Shearer	2,000,000		0
Teddy	Sherringham	150,000		0
Zinedine	Zindane	3,000,000		0
				0
Totals			0	0

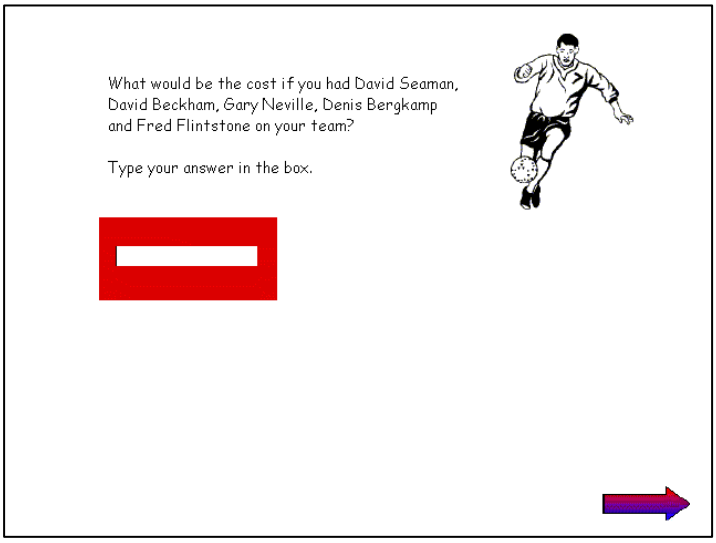


The children have the Fantasy Football spreadsheet open.

Answer

1

ATTEMPT NUMBER	SYSTEM RESPONSES
No answer	"You have to type in your answer before continuing <Name>."
1	"Try again - you can do it, just think carefully"
2	"You are looking for a number"
3	"Find column C and try again"
4	"Look for row 14 now"
5-11	"Find the column with C at the top and read down to row 14"
12	"Preceded by warning message box"

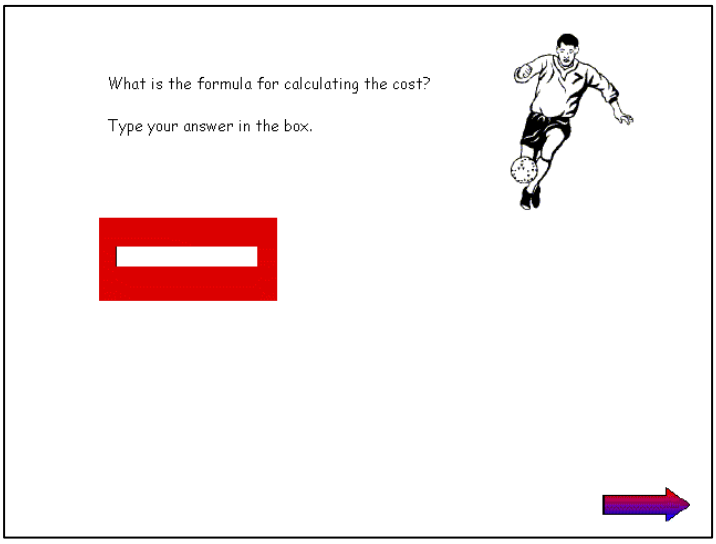


Answer

4022276

The children are expected to select the players and look in the total box – this is a similar exercise to the Spreadsheets worksheet

ATTEMPT NUMBER	SYSTEM RESPONSES
No answer	"You have to type in your answer before continuing <Name>."
1	"Try again – you can do it, just think carefully"
2	"Think about what you need to do in column D."
3	"How many of each player do you need?"
4	"Put a 1 in Column D, the 'How many?' column, in the same row as David Seaman and so on through all the names on the list."
5-11	"Look in the cell E20 after you have put a 1 by all 5 names."
12	Preceded by warning message box



Answer

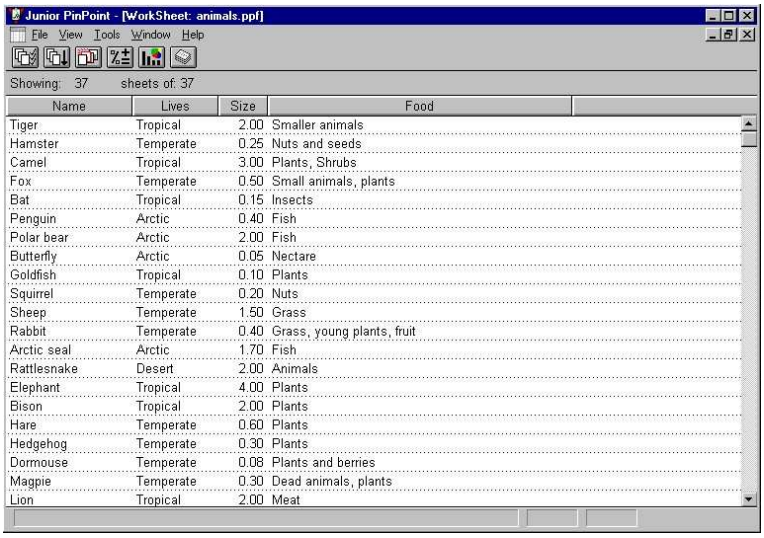
=sum(e4:e19)

(The children could type their answer in upper or lower case)

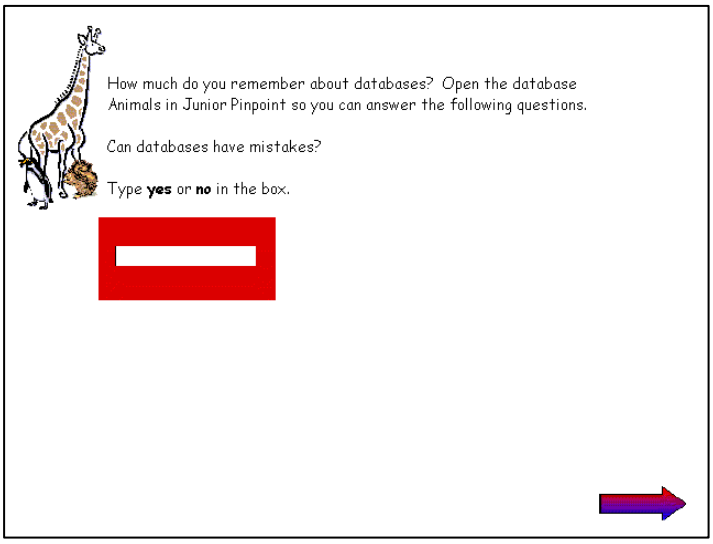
ATTEMPT NUMBER	SYSTEM RESPONSES
No answer	"You have to type in your answer before continuing <Name>."
1	"Try again – just think carefully <Name>"
2	"You have to click on the cell where the total cost is."
3	"Click on cell D20 and then try and find the formula."
4	"Formulas do not appear in any columns or rows."
5-11	"Look above column B."
At any time	If the child misses out "=" at the start of the formula "What do formula's always begin with?)"
12	Preceded by warning message box

Database questions

Requires the Junior Pinpoint file "Animals.ppf", using the "analyse data sheets" screen shown below:



Name	Lives	Size	Food
Tiger	Tropical	2.00	Smaller animals
Hamster	Temperate	0.25	Nuts and seeds
Camel	Tropical	3.00	Plants, Shrubs
Fox	Temperate	0.50	Small animals, plants
Bat	Tropical	0.15	Insects
Penguin	Arctic	0.40	Fish
Polar bear	Arctic	2.00	Fish
Butterfly	Arctic	0.05	Nectare
Goldfish	Tropical	0.10	Plants
Squirrel	Temperate	0.20	Nuts
Sheep	Temperate	1.50	Grass
Rabbit	Temperate	0.40	Grass, young plants, fruit
Arctic seal	Arctic	1.70	Fish
Rattlesnake	Desert	2.00	Animals
Elephant	Tropical	4.00	Plants
Bison	Tropical	2.00	Plants
Hare	Temperate	0.60	Plants
Hedgehog	Temperate	0.30	Plants
Dormouse	Temperate	0.08	Plants and berries
Magpie	Temperate	0.30	Dead animals, plants
Lion	Tropical	2.00	Meat

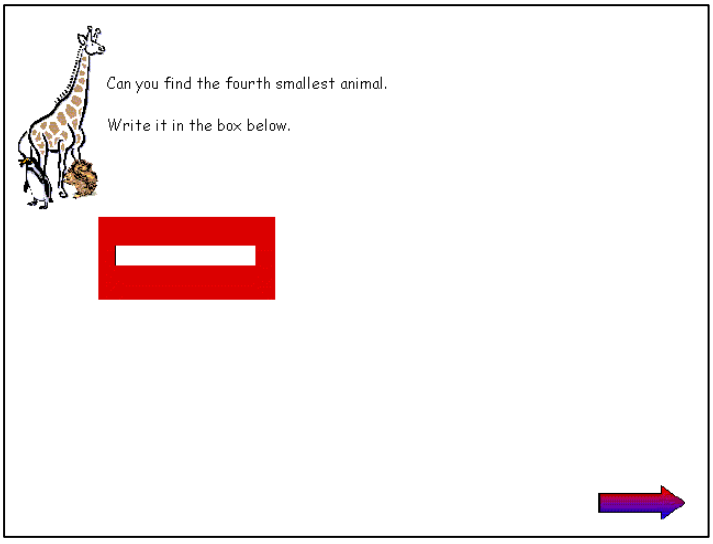


Answer

Yes

(The children could type their answer in upper or lower case)

ATTEMPT NUMBER	SYSTEM RESPONSES
Any time	No answer or a word that is not "yes" or "no" "You have to type yes or no in the box."
1+	*If the child types "no"* "Hmmmmmmmm"
2+	*If the child still types "no"* "Are you really sure?"
Next go	Preceded by warning message box



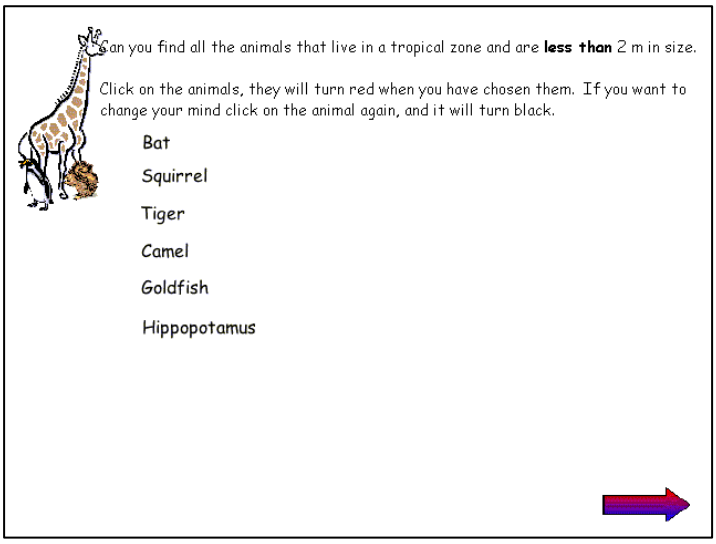
Answer

Dormouse

This requires the child to sort the database by size.

(The children could type their answer in upper or lower case)

ATTEMPT NUMBER	SYSTEM RESPONSES
No answer	"You must type in an animal."
1	"Try again <Name>."
2	"First you have to go to the list view, click on the icon that looks like a graph <picture of icon>. Then try and sort."
3	"You need to sort by size."
4	"Click on Tools, Sort sheets…, and have another go <Name>."
5-11	"Click on the icon <picture of icon> Click on Tools, Sort sheets… Click on the word 'Size' so it goes blue Click in the circle by the word Increasing Look for the fourth animal down"
12	Preceded by warning message box



Answer

Goldfish

Hippopotamus

Bat

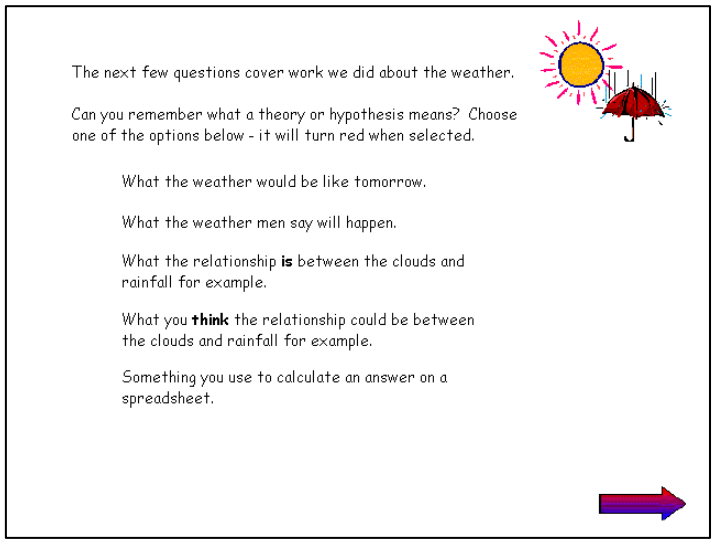
The children have to sort by zone and by size to find the answer

(The children could type their answer in upper or lower case)

ATTEMPT NUMBER	SYSTEM RESPONSES
Less than 3 animals selected	"You have to click on three of the animals "
1	"Try again <Name>"
2	"First you have to go to the list view, click on the icon that looks like a graph <picture of icon>. Then try and find the animals."
3	"You need to constrain by size and where it lives."
4	"Click on Tools, Add Condition… and then put in the two conditions 'Size' and 'lives'."

5-11	*Detailed instructions if the child is still stuck.* "Click on the icon Click on Tools, Add Condition Click on the word 'Size' so it goes blue. In the value box type 2 and make sure the circle is by 'Is less than' and click on OK Click on Tools, Add Condition Click on the word 'Lives' so it goes blue. In the value box click on 'Tropical' so it goes blue and click on OK 6) You should be left with 3 animals."
12	Preceded by warning message box

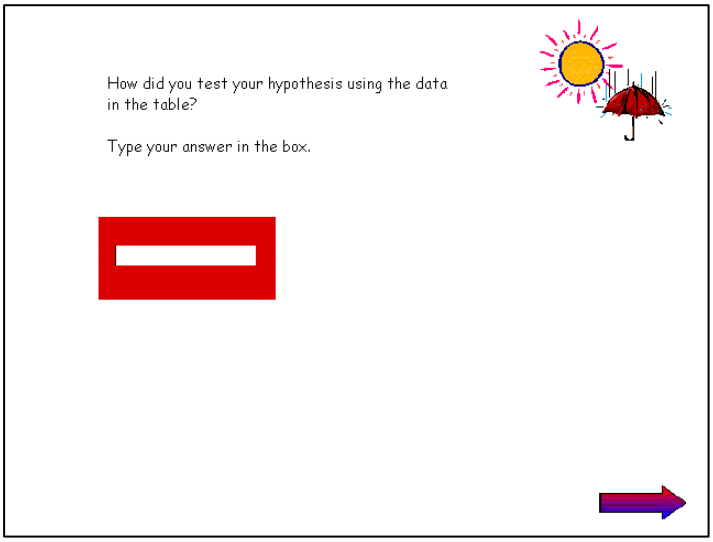
Questions about hypotheses



Answer

What you think the relationship could be between the clouds and rainfall for example

ATTEMPT NUMBER	SYSTEM RESPONSES
No item selected	"Please click on one of the possible definitions"
1	"Try again you can do it"
2	"You can have a hypothesis about anything, it's not just to do with the weather <Name>"
3	"The following is an example of a hypothesis. 'I think if you wear pink pyjamas you will do well in exams.' So what do you think a hypothesis is?"
4 - 11	"Or I could say 'I think there is a relationship between wearing pink pyjamas and doing well in exams.' Try again <Name>"
12	Preceded by warning message box



Answer

The application accepts a phrase with "graph" in it, e.g.,

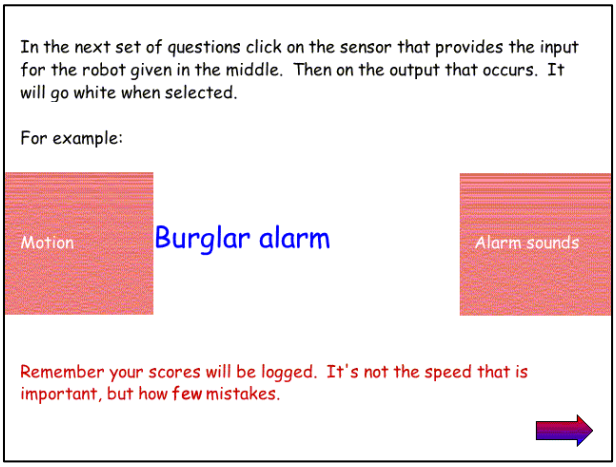
"Plot a graph"

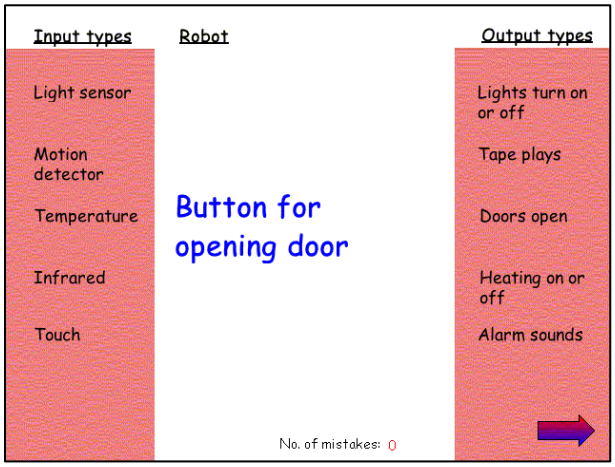
(The children could type their answer in upper or lower case)

ATTEMPT NUMBER	SYSTEM RESPONSES
No answer	"Type in your answer <Name>"
1	"Try again - you can do it <Name>"
2	"How did we check the hypotheses you made about the weather?"
3	"Click on which one you think it is: Look outside Plot a graph Add up the columns Do not do anything"
4-11	*Wrong answer or nothing selected* "That was the wrong answer Try again by clicking on another definition"
12	Preceded by warning message box

Robot input and output

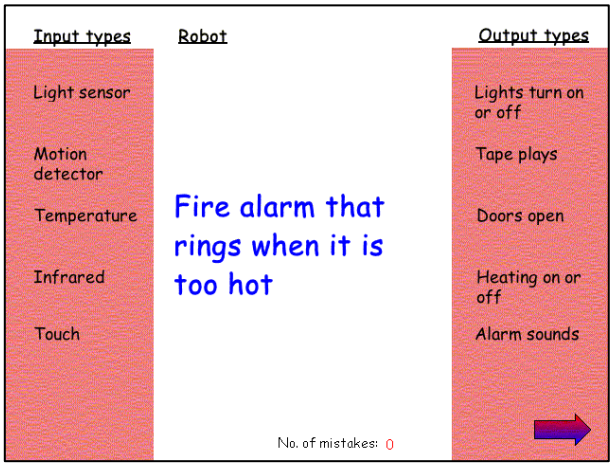
The order of the three questions after the introductory screen is random.





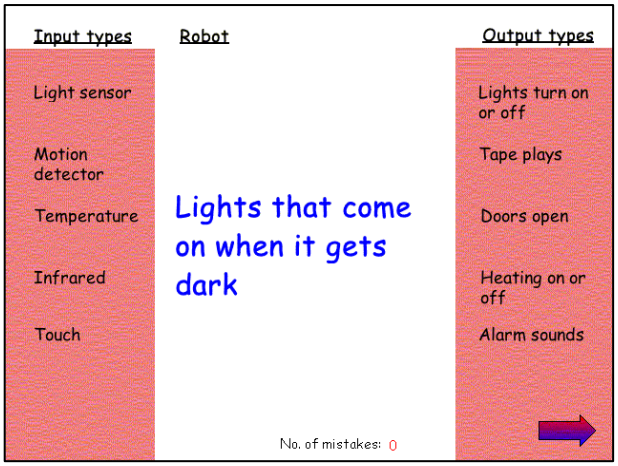
Answer

Touch *and* Doors open



Answer

Temperature *and* Alarm sounds



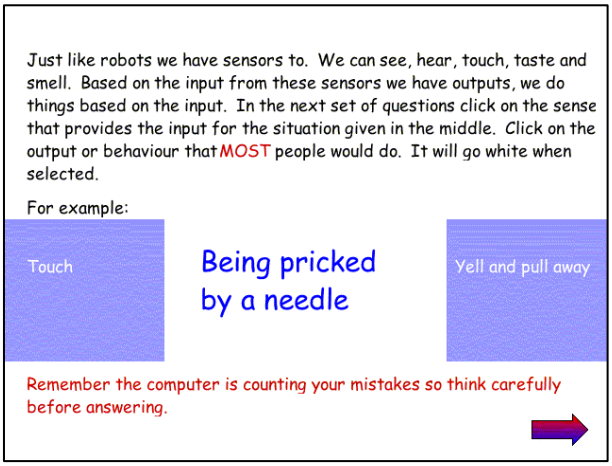
Answer

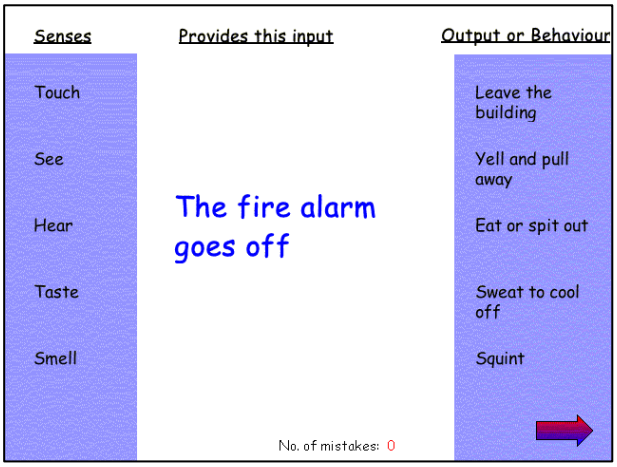
Light sensor *and* Lights turn on or off

ATTEMPT NUMBER	SYSTEM RESPONSES
No answer	"You need to select an Input and an Output"
Any time	*Child only clicked on an input* "You need to choose an Output."
Any time	*Child only clicked on an output* "You need to choose an Input."
1	"Think about it a bit more carefully <Name>. From this point number of mistakes counter increments"
2-11	*Dependent on response:* "You have the Input AND the Output wrong." "You have the Input wrong." "You have the Output wrong."
12	Preceded by warning message box

Human input and output

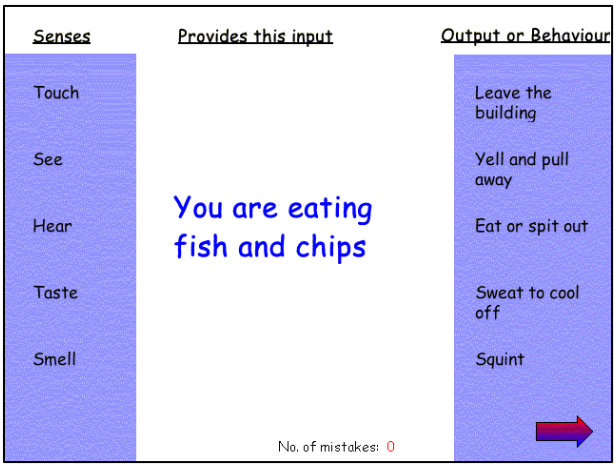
The order of the three questions after the introductory screen is random.





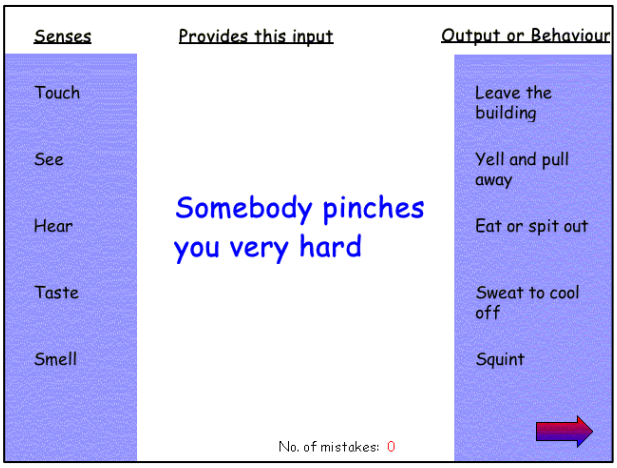
Answer

Hear *and* Leave the building



Answer

Taste *and* Eat or spit out



Answer

Touch *and* Yell and pull away

ATTEMPT NUMBER	SYSTEM RESPONSES
No answer	"You need to select a Sense and an Output or Behaviour"
Any time	*Child only clicked on a Sense* "You need to choose an Output or Behaviour."
Any time	*Child only clicked on an Output or Behaviour* "You need to choose an Sense."
1	"Think about it a bit more carefully <Name>. From this point number of mistakes counter increments"
2-11	*Dependent on response:* "You have the Sense AND the Output or Behaviour wrong." "You have the Sense wrong." "You have the Output or Behaviour wrong."
12	Preceded by warning message box